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ABSTRACT

This document, which is the second part of a two-part set of modules on anatomy and physiology for future surgical technicians, contains the teacher and student editions of an introduction to anatomy and physiology that consists of modules on the following body systems: integumentary system; skeletal system; muscular system; nervous system; endocrine system; special senses; circulatory system (blood); circulatory system (cardiac); circulatory system (vascular); lymphatic system; respiratory system; digestive system; urinary system; reproductive system (male); and reproductive system (female). The teacher edition contains an introductory section and the learning modules. The introduction presents the following materials: an overview of the materials and guidelines for their use; an instructional/task analysis; academic and workplace skill classifications and definitions; a list of related academic and workplace skills; and a crosswalk to Association of Surgical Technologists core curriculum objectives. The remainder of the teacher's edition consists of the learning modules plus the following items for each: suggested activities; transparency masters; written tests and test answers; assignment sheets and answers; crossword puzzles and answers; and module reviews and answers. The student edition consists of the 15 learning modules, each of which contains the following elements: learning activity sheets; module objective sheet; information sheets; student supplements; student assignment sheets. (MN)

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Anatomy and Physiology
Teacher Edition [and] Student Edition

Module Set II: Major Body Systems

Surgical Technology

MAVCC

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Module Set II:
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Surgical Technology

Anatomy and Physiology

Module Set II:
Major Body Systems

Teacher Edition

Project written by
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Contents

Acknowledgments iii
Use of introductory materials v
Use of this publication vii
Instructional/task analysis xi
Academic and workplace skill classifications and definitions xxvii
Related academic and workplace skills list xxix
Crosswalk to AST core curriculum xxxix

MODULES WITHIN SET

Module 1: Integumentary System
Module 2: Skeletal System
Module 3: Muscular System
Module 4: Nervous System
Module 5: Endocrine System
Module 6: Special Senses
Module 7: Circulatory System—Blood
Module 8: Circulatory System—Cardiac
Module 9: Circulatory System—Vascular
Module 10: Lymphatic System
Module 11: Respiratory System
Module 12: Digestive System
Module 13: Urinary System
Module 14: Reproductive System—Male
Module 15: Reproductive System—Female

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Use of Introductory Materials

Introductory materials are included in the teacher edition only and contain useful information to assist administrators and teachers in planning for instruction.

In addition to the general information—such as the table of contents and acknowledgments page—information is included on the following:

1. **Use of this publication**—Explains the components of a module of instruction and how they should be used as part of the teaching/learning process.

2. **Instructional/task analysis**—Provides a quick review of the contents of the publication; identifies cognitive (knowledge) skills addressed in each module of instruction.

3. **Academic and workplace skill classifications and definitions**—Defines the basic-skill classifications used by MAVCC. Skill areas reflected by skill groups, subskills, and descriptions have been identified using *What Work Requires of Schools: A SCANS Report for America 2000* and *Workplace Basics: The Skills Employers Want*. These have been adapted by MAVCC.

4. **Related academic and workplace skills list**—Classifies assignment sheets according to the related academic and workplace skills being reinforced.

5. **Crosswalk to AST Core Curriculum Objectives**—Indicates MAVCC module objectives identified in the Association of Surgical Technologists, Inc.'s, *Core Curriculum for Surgical Technology*, 4th ed., Englewood, Colorado, copyright 1996.

As you use these materials, it is hoped that they will provide useful information to meet a variety of needs.

Use of This Publication

Instructional modules

Anatomy and Physiology consists of two editions: *Module Set I, Introduction to Anatomy and Physiology*, and this publication, *Module Set II, Major Body Systems*.

Module Set I contains four modules of instruction:

Module 1: Organization of the Human Body
Module 2: Biochemistry and Microbiology
Module 3: Infection, Immunology, and Sanitation
Module 4: Tissues, Membranes, and Wound Healing

Module Set II contains 15 modules of instruction:

Module 1: Integumentary System
Module 2: Skeletal System
Module 3: Muscular System
Module 4: Nervous System
Module 5: Endocrine System
Module 6: Special Senses
Module 7: Circulatory System—Blood
Module 8: Circulatory System—Cardiac
Module 9: Circulatory System—Vascular
Module 10: Lymphatic System
Module 11: Respiratory System
Module 12: Digestive System
Module 13: Urinary System
Module 14: Reproductive System—Male
Module 15: Reproductive System—Female

Each instructional module in a student edition includes some or all of the following components: learning activities sheet, module objective sheet, information sheet, student supplements, and assignment sheets.

Each module in this teacher edition includes some or all of the following components for each of the modules of instruction: suggested activities, transparency masters, teacher supplements, written test, answers to written test, answers to assignment sheets, optional assignment sheets, answers to optional assignment sheets, crossword puzzles, answers to crossword puzzles, module review, and answers to module review.

All of the module components focus on measurable and observable learning outcomes. Teachers are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

Modules of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each module of instruction by the teacher will help to determine the following:

- Amount of materials that can be covered in each class period.
- Skills that must be demonstrated.
- Amount of class time needed for teacher demonstrations.

- Amount of time needed for student practice.
- Supplementary materials, including print and nonprint media and equipment and supplies, that must be ordered.
- Resource people who must be contacted.

Student-edition components

It is a challenge to keep students motivated. Instructors should supplement the student-edition components by providing the "why," personal experiences, and current information. Prepare for each module by deciding how each component can best be taught. Allow students to become involved in preparing and planning their teaching/learning experiences.

Learning activities sheet. The learning activities sheet supplied in each module is a step-by-step instruction sheet instructors may use to guide each student's individual study through the required components in the student edition (module objective sheet, information sheet, student supplements, and assignment sheets). The learning activities sheet also provides space for the instructor to include selected web sites and optional assignments and activities, which allow the instructor to use his or her discretion in providing students with additional objectives in the same subject area as the required objectives provided in the student edition.

Module objective sheet. Each module of instruction is based on performance objectives that state the goals for successful completion of the course. These performance objectives are stated in two forms: module objectives, which state the expected performance of each student after completion of the module of instruction, and specific objectives, which state what the student must do to reach the module objective.

The objectives should be stressed throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional module. The objectives can also help determine teaching strategies and instructional methods. Teachers should prepare for each module by deciding how each objective can best be taught.

Teachers should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When objectives are added, the teacher should remember to supply the needed information-sheet, assignment-sheet, written-test, and module-review items.

Information sheet. The information sheet provides the content essential for meeting the cognitive (knowledge) objectives of the module. Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the module objective.

Student supplements. The information presented in a student supplement may consist of tables, charts, written information, forms, or other information students will need in order to complete one or more of the assignment sheets. Students are not directly tested over the information presented in a supplement; however, their ability to apply this information will be evaluated in the completion of an assignment sheet.

Assignment sheets. Assignment sheets provide students with pencil-and-paper activities that give students the opportunity to make practical application of the knowledge in the information sheet and student supplements. Criteria are provided to objectively evaluate student performance.

Teacher-edition components

Suggested activities. The suggested activities assist teachers during the preparation stage of the teaching/learning process by providing an instructional plan, teaching suggestions, and a list of supplemental resources. The teacher should read the suggested activities before teaching a module and decide how each objective can best be taught. Time should also be allowed to obtain supplemental materials, prepare audiovisual materials, and contact outside resources. Duties of the teacher will vary according to the particular module.

References used in the development of each module, suggested web sites for student use, and supplemental resources are listed in the suggested activities. These materials can be used by the teacher to supplement her or his knowledge of the subject area or to help students with objectives in the area covered by a module of instruction.

Transparency masters. Transparency masters provide illustrations, charts, schematics, or additional information a teacher may use in group discussion to direct the students' attention to the topic of discussion.

Written test. This component is a criterion-referenced evaluation of the cognitive objectives presented in the information sheet. If the instructor has added, deleted, or modified objectives presented in the information sheet, appropriate changes should be made on the written test. It is recommended that the test be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered and before students attempt the assignment sheets presented in the student edition. The written test is included in the teacher edition only, but duplication is permitted for student use.

Answers to written test. These answers are designed to assist the teacher in evaluating student performance on the written test.

Answers to assignment sheets. Assignment-sheet answers are designed to assist the teacher in evaluating student performance on the assignment sheets presented in the student edition.

Optional assignment sheets. When present in the teacher edition, these are optional assignments for the teacher to use to provide students with higher-level materials to stretch the advanced student or with remedial information or practice to assist the less-advanced student. These optional assignments may be duplicated for student use.

Answers to optional assignment sheets. These answers are designed to assist the teacher in evaluating student performance on the optional assignments presented in the teacher edition.

Crossword puzzles. Medical terminology and the spelling of medical terms are often difficult for students of anatomy and physiology. Crossword puzzles are presented in the teacher edition as optional resources for teachers to use to give their students practice in learning to spell and define the medical terms presented in each module of instruction. The crossword puzzles are included in the teacher edition only, but duplication is permitted for student use.

Answers to crossword puzzles. These answers are designed to assist the teacher in evaluating student performance on the crossword puzzles.

Module review. The module review is an objective test of the information presented in any of the components presented in the student edition. The objective questions are designed to test on many cognitive levels, and an attempt has been made to present some critical-thinking objective items in each module review. The module review is included in the teacher edition only, but duplication is permitted for student use.

A selection of test items from the modules covered may be used for a final test at the end of each term if desired. It is hoped that the objective format of the module reviews will help students prepare for the tests they must pass for certification in the various surgical-technology areas.

Answers to module review. These answers are designed to assist the teacher in evaluating student performance on the module review.

Instructional/Task Analysis

Module 1: Integumentary System

Related information: What the student should know

1. Define the term *integument.*
2. List the major structures that make up the integument.
3. Complete statements that describe the characteristics of the skin.
4. List the functions of the skin.
5. Describe the major structures of the skin.
6. Match the layers of the epidermis to their correct descriptions.
7. Distinguish between descriptions of the layers of the dermis.
8. Define the term *auxiliary appendage.*
9. Complete statements that describe the characteristics of hair.
10. Complete statements that describe the characteristics of nails.
11. State the functions of the glands located in the skin.
12. List the types of nerve endings found in the skin.
13. Label the major structures of the integument.
14. Match common disorders and abnormalities of the integument to their correct definitions.

Application: What the student should be able to do

15. Practice critical thinking: investigate skin cancer. (Assignment Sheet 1)
16. Practice critical thinking: investigate burns. (Assignment Sheet 2)

Module 2: Skeletal System

Related information: What the student should know

1. Define the term *skeletal system.*
2. State the functions of the skeletal system.
3. Distinguish between phrases that describe the characteristics of bone and cartilage.

Module 2: Skeletal System (cont.)

Related information: What the student should know (cont.)

4. List the major components of bones.
5. Complete statements that describe the types of bones as classified by their location and structure.
6. State the characteristics of bone marrow.
7. Define the major structures of a long bone.
8. Label the major structures of a long bone.
9. Match the long bones of the skeleton to their correct definitions.
10. Define terms that describe the cavities and processes of bones.
11. Describe the major divisions of the human skeleton.
12. Label the major components of the anterior and posterior axial skeleton.
13. Label the major bones of the anterior and posterior appendicular skeleton.
14. Define the major bones and structures of the cranium, face, and ear.
15. Label the major bones and structures of the cranium, face, and ear.
16. State the characteristics of the hyoid bone.
17. Define the regions and the major bones and structures of the vertebral column.
18. Label the regions and the major bones and structures of the vertebral column.
19. Complete statements that describe the characteristics of the ribs and sternum.
20. Label the major bones and structures of the ribs and sternum.
21. Define the term *articular system.*
22. State the functions of the articular system.
23. Complete statements that describe the major structures and substances of the articular system.
24. Distinguish among phrases that describe the types of articulations.
25. Describe types of amphiathrosis articulations.
26. Match types of diathrosis articulations to their correct descriptions.
27. Match common disorders and abnormalities of the skeletal system to their correct definitions.

Module 2: Skeletal System (cont.)

Application: What the student should be able to do

28. Classify bone fractures. (Assignment Sheet 1)

29. Practice critical thinking: research the current medical understanding of the causes and treatments of rheumatoid arthritis. (Assignment Sheet 2)

Module 3: Muscular System

Related Information: What the student should know

1. Define the term *muscular system.*
2. State the functions of the muscular system.
3. Describe the major classifications of muscle tissue.
4. Define the major structures of skeletal muscles.
5. Label the major structures of skeletal muscles.
6. Complete statements that describe the characteristics of the bone/muscle attachments of skeletal muscles.
7. Complete statements that describe how skeletal muscles function.
8. Define terms that describe the functional characteristics of muscle tissue.
9. State the actions performed by the types of muscles as classified by their actions.
10. Define terms that describe how muscles function during coordinated movement.
11. State the functions of the major muscle groups.
12. State the functions of the major muscles of the neck, head, and face.
13. Label the major muscles of the neck, head, and face.
14. State the functions of the major muscles of the torso.
15. Label the major muscles of the torso.
16. State the functions of the major muscles of the arms.
17. Label the major muscles of the arms.
18. State the functions of the major muscles of the legs.
19. Label the major muscles of the legs.
20. Match common disorders and abnormalities of the muscular system to their correct definitions.

Module 3: Muscular System (cont.)

Application: What the student should be able to do

21. Practice critical thinking: determine common intramuscular injection sites. (Assignment Sheet 1)
22. Practice critical thinking: report on disorders and abnormalities of the muscular system. (Assignment Sheet 2)

Module 4: Nervous System

Related Information: What the student should know

1. Define the term *nervous system.*
2. State the functions of the nervous system.
3. Describe the major subsystems of the nervous system.
4. Describe the major subsystems of the peripheral nervous system.
5. Describe the major subsystems of the autonomic nervous system.
6. Define the term *nerve tissue.*
7. Define the basic types of nerve tissue.
8. State the functions of the major structures of a neuron.
9. Label the major structures of a neuron.
10. Define the term *nerve fiber.*
11. Define the major structures of a nerve fiber.
12. Label the major structures of a nerve fiber.
13. Match types of neurons to their correct descriptions.
14. Complete statements that describe the transmission of nerve impulses.
15. Complete statements that describe a reflex arc.
16. Label the major structures of a reflex arc.
17. Describe the stages in the regeneration of a peripheral nerve.
18. State the functions of the types of neuroglia.
19. List the major structures within the spinal canal.
20. Complete statements that describe the structure and functioning of the spinal cord.
21. State the function of cerebrospinal fluid.

Module 4: Nervous System (cont.)

Related information: What the student should know (cont.)

22. List the components of cerebrospinal fluid.
23. Define the major structures of the meninges.
24. Define the primary divisions of the brain.
25. Label the primary divisions of the brain.
26. Define the major structures of the forebrain and the hindbrain.
27. Label the major structures of the forebrain and the hindbrain.
28. Define the terms *hemisphere*, *sulcus*, *fissure*, *lobe*, and *ventricle*.
29. Define the lobes of the cerebrum.
30. Define the fissures of the cerebrum.
31. Label the visible lobes and fissures of the cerebrum.
32. Label the functional areas of the brain.
33. Complete statements that describe the structure and functioning of the ventricles of the brain.
34. Label the ventricles of the brain and the horns of the lateral ventricles.
35. State the number and functions of the cranial nerves of the peripheral nervous system.
36. Define the term *plexus*.
37. Label the plexuses of the spinal cord.
38. Describe the number and origin of the spinal nerves.
39. List the major nerves that arise from each plexus.
40. Match common disorders and abnormalities of the nervous system to their correct definitions.

Application: What the student should be able to do

41. Practice critical thinking: investigate nerve-block anesthetics. (Assignment Sheet 1)

Module 5: Endocrine System

Related information: What the student should know

1. Define the term *endocrine system*.
2. List the primary physiological characteristics of the body that are affected by the hormones of the endocrine system.

Module 5: Endocrine System (cont.)

Related information: What the student should know (cont.)

3. Match the major glands of the endocrine system to their correct definitions.
4. Label the major glands of the endocrine system.
5. Complete statements that describe the structure and function of the pituitary gland.
6. Match the primary hormones of the pituitary gland to their correct functions.
7. Define common disorders and abnormalities associated with the hormones of the pituitary gland.
8. Complete statements that describe the function of the thyroid gland.
9. Define common disorders and abnormalities associated with the hormones of the thyroid gland.
10. Complete statements that describe the function of the parathyroid glands.
11. Define common disorders and abnormalities associated with the hormones of the parathyroid glands.
12. Complete statements that describe the structure and function of the adrenal glands.
13. Match the primary hormones of the adrenal glands to their correct functions.
14. Define common disorders and abnormalities associated with the hormones of the adrenal glands.
15. Complete statements that describe the function of the gonads.
16. Describe the common disorders and abnormalities associated with the hormones of the gonads.
17. Complete statements that describe the function of the pancreas (islets of Langerhans).
18. Define common disorders and abnormalities associated with the hormones of the pancreas (islets of Langerhans).
19. Complete statements that describe the function of the pineal body.
20. Complete statements that describe the function of the thymus gland.
21. Complete statements that describe the endocrine functions of organs in the body that are not classified as endocrine glands.

Application: What the student should be able to do

22. Practice critical thinking: complete case studies that determine medical interventions for endocrine disorders. (Assignment Sheet 1)

Module 6: Special Senses

Related information: What the student should know

1. Define the term *special sense*.

Module 6: Special Senses (cont.)

Related Information: What the student should know (cont.)

2. Describe the stages in a sensory response.
3. Define the major special senses.
4. Define other senses that may also be associated with the special senses.
5. Define the major layers and cavities of the eye.
6. Complete statements that describe the major muscles of the eye.
7. Define the major structures of the eye.
8. Label the major structures of the eye.
9. Complete statements that describe the sensory response for vision.
10. Define the accessory structures of the eye.
11. Match common disorders and abnormalities of the eye to their correct definitions.
12. Define the major sections of the ear.
13. Describe the types of conduction used to transmit sound within the ear.
14. Define the major structures of the ear that function in sound transmission (hearing).
15. Define the major structures of the ear that function to maintain equilibrium.
16. Describe the function of the branches of the acoustic nerve (cranial nerve VIII).
17. Label the major sections and structures of the ear.
18. Define common disorders and abnormalities of the ear.
19. Complete statements that describe the sensory response for the sense of smell.
20. Define common disorders and abnormalities associated with the sense of smell.
21. Complete statements that describe the sensory response for the sense of taste.
22. Define the common disorder associated with the sense of taste.
23. Label the major structures of the nose and mouth associated with the senses of smell and taste.
24. Complete statements that describe the sensory responses for the senses of touch and pain.
25. Define common disorders and abnormalities associated with the senses of touch and pain.

Module 6: Special Senses (cont.)

Application: What the student should be able to do

26. Practice critical thinking: investigate the functioning of the special senses. (Assignment Sheet 1)

Module 7: Circulatory System—Blood

Related information: What the student should know

1. Define the term *circulatory system.*
2. State the functions of the circulatory system.
3. List the subsystems of the circulatory system.
4. Match the major organs of the circulatory system to their correct definitions.
5. Define the major components of blood.
6. Complete statements that describe the normal physical characteristics of blood.
7. List the major components of blood plasma.
8. Complete statements that describe the characteristics of erythrocytes.
9. Complete statements that describe the characteristics of leukocytes.
10. Complete statements that describe the characteristics of thrombocytes.
11. Define the term *hematology.*
12. Define common tests used in hematologic studies.
13. State the normal parameters of the common tests used in hematologic studies.
14. Complete statements that describe the characteristics of the Rh blood-group factor.
15. Complete statements that describe the characteristics of the human blood groups (blood types).
16. Describe the factors that must be considered when blood is matched for a transfusion.
17. Complete statements that describe the blood-clotting process (blood coagulation).
18. Match common disorders and abnormalities of the blood to their correct definitions.

Application: What the student should be able to do

19. Practice critical thinking: complete case studies on the role of blood in maintaining good health. (Assignment Sheet 1)

Module 8: Circulatory System—Cardiac

Related information: What the student should know

1. Define the term *cardiovascular system.*
2. Complete statements that describe the size and position of the heart.
3. List the major structures of the heart.
4. Define the tissue layers of the heart.
5. Complete statements that describe the characteristics of the chambers of the heart.
6. Complete statements that describe the characteristics of the major veins of the heart.
7. Complete statements that describe the characteristics of the major arteries of the heart.
8. Complete statements that describe the characteristics of the major valves of the heart.
9. Label the major structures of the heart.
10. Define the term *cardiopulmonary circulation.*
11. Arrange in order the sequence of blood flow in cardiopulmonary circulation.
12. Complete statements that describe the characteristics of the coronary arteries and veins.
13. Define the term *conduction system of the heart.*
14. Define the major structures of the conduction system of the heart.
15. State the sequence for the conduction of a contraction of the heart in a heartbeat.
16. Define the sounds of a heartbeat.
17. Match common disorders and abnormalities of the heart to their correct definitions.

Application: What the student should be able to do

18. Practice critical thinking: describe and evaluate types of cardiac pacemakers. (Assignment Sheet 1)

Module 9: Circulatory System—Vascular

Related information: What the student should know

1. Define the term *vascular system.*
2. List the major structures of the vascular system.
3. Define the term *systemic circulation system.*
4. State the sequence of blood circulation through the major structures of the systemic circulation system.

Module 9: Circulatory System—Vascular (cont.)

Related information: What the student should know (cont.)

5. Define the tissue layers of an artery.
6. Label the tissue layers of an artery.
7. Complete statements that describe the characteristics of arteries.
8. Complete statements that describe the characteristics of the aorta in the systemic arterial circulation system.
9. Define the major arteries that extend from the aorta.
10. Label the major arteries of the systemic circulation system.
11. Complete statements that describe the characteristics of capillaries.
12. Define the tissue layers of a vein.
13. Label the tissue layers of a vein.
14. Complete statements that describe the characteristics of veins.
15. Define the major veins of the systemic circulation system.
16. Label the major veins of the systemic circulation system.
17. Define the term *portal circulation system.*
18. Complete statements that describe the characteristics of the portal circulation system.
19. Define the term *pulse point.*
20. State the normal pulse rate of a healthy adult at rest.
21. Label the common pulse points.
22. Define the term *blood pressure.*
23. Complete statements that describe how blood pressure is measured.
24. Describe the factors that affect blood pressure.
25. Complete statements that describe the characteristics of the fetal circulation system.
26. Define common disorders and abnormalities of the vascular system.

Application: What the student should be able to do

27. Practice critical thinking: determine cause-and-effect relationships related to the circulatory system. (Assignment Sheet 1)

Module 10: Lymphatic System

Related information: What the student should know

1. Define the term *lymphatic system.*
2. List the major structures of the lymphatic system.
3. Label the major structures of the lymphatic system.
4. State the sequence of lymph circulation through the major structures of the lymphatic system.
5. Complete statements that describe the characteristics of lymph and its movement through the body.
6. Complete statements that describe the characteristics of lymphatic capillaries.
7. Complete statements that describe the characteristics of lymphatic vessels.
8. Complete statements that describe the characteristics of lymph nodes.
9. Define the major groups of lymph nodes.
10. Label the major groups of lymph nodes.
11. Define the major lymphatic ducts.
12. Label the major lymphatic ducts.
13. Define the term *lymph nodule.*
14. Complete statements that describe the characteristics of the spleen.
15. Complete statements that describe the characteristics of the thymus.
16. Complete statements that describe the characteristics of the tonsils.
17. Label the tonsils of the mouth and throat.
18. Define common disorders and abnormalities of the lymphatic system.

Application: What the student should be able to do

19. Practice critical thinking: investigate the involvement of the lymphatic system in interventions for cancer. (Assignment Sheet 1)

Module 11: Respiratory System

Related information: What the student should know

1. Define the term *respiratory system.*
2. Complete statements that describe the characteristics of pulmonary ventilation.
3. Define terms used to measure the various aspects of respiratory volume.

Module 11: Respiratory System (cont.)

Related information: What the student should know (cont.)

4. Complete statements that describe the portions of the thorax that are related to the lungs.
5. Define the major organs and structures of the respiratory system.
6. Label the major organs and structures of the respiratory system.
7. Complete statements that describe the characteristics and structures of the nose that are related to the respiratory system.
8. Complete statements that describe the characteristics of the pharynx that are related to the respiratory system.
9. Complete statements that describe the characteristics and structures of the larynx that are related to the respiratory system.
10. Complete statements that describe the characteristics and structures of the trachea.
11. Complete statements that describe the characteristics and structures of the bronchi.
12. Label the major structures of the bronchi.
13. Complete statements that describe the characteristics and structures of the lungs.
14. Label the major external structures of the lungs.
15. Complete statements that describe the characteristics and structures of the pleura.
16. Label the major structures of the pleura.
17. Complete statements that describe the muscles that change the size of the thorax.
18. Match common disorders and abnormalities of the respiratory system to their correct definitions.

Application: What the student should be able to do

19. Practice critical thinking: investigate lung-transplant procedures. (Assignment Sheet 1)

Module 12: Digestive System

Related information: What the student should know

1. Define the term *digestive system.*
2. State the functions of the digestive system.
3. Define the term *alimentary tract.*
4. Define the organs and structures of the alimentary tract.
5. Define the term *accessory glands.*
6. Define the accessory glands of the digestive system.

Module 12: Digestive System (cont.)

Related information: What the student should know (cont.)

7. Label the major organs and structures of the digestive system.
8. Complete statements that describe the characteristics and structures of the mouth.
9. Label the major structures of the mouth.
10. Complete statements that describe the characteristics and structures of the teeth.
11. Label the major structures of a tooth.
12. Define the types of teeth as classified by location and function.
13. Label the types of teeth as classified by location and function.
14. Complete statements that describe the characteristics and structures of the pharynx that relate to the digestive system.
15. Complete statements that describe the characteristics and structures of the esophagus.
16. Define the major structures of the stomach.
17. Label the major structures of the stomach.
18. Complete statements that describe the characteristics and functions of the stomach.
19. Define the major structures of the small intestine.
20. Complete statements that describe the characteristics and functions of the small intestine.
21. Define the major structures of the large intestine.
22. Define the sections and flexures of the colon.
23. Label the major structures of the large intestine.
24. Complete statements that describe the characteristics and functions of the large intestine.
25. Complete statements that describe the characteristics and structures of the liver.
26. List the functions of the liver.
27. Complete statements that describe the characteristics and structures of the pancreas.
28. Complete statements that describe the characteristics and structures of the gallbladder.
29. Label the major structures of the liver, pancreas, and gallbladder.
30. Match common disorders and abnormalities of the alimentary tract to their correct definitions.

Application: What the student should be able to do

31. Practice critical thinking: investigate surgical requirements for the digestive system. (Assignment Sheet 1)

Module 13: Urinary System

Related information: What the student should know

1. Define the term *urinary system.*
2. State the functions of the urinary system.
3. Define the major organs and structures of the urinary system.
4. Label the major organs and structures of the urinary system.
5. Complete statements that describe the characteristics and external structure of the kidneys.
6. Define the major internal macroscopic structures of a kidney.
7. Label the major internal macroscopic structures of a kidney.
8. Complete statements that describe the characteristics of the internal microscopic structures of a kidney.
9. Label the major microscopic structures of a nephron.
10. State functions of the kidneys.
11. Complete statements that describe the characteristics and structure of the ureters.
12. Complete statements that describe the characteristics and structure of the urinary bladder.
13. Complete statements that describe the characteristics and structure of the female urethra.
14. Complete statements that describe the characteristics and structure of the male urethra.
15. Complete statements that describe the normal physical characteristics of urine.
16. Complete statements that describe the processes for producing and expelling urine.
17. List the common abnormal constituents of urine.
18. Complete statements that describe the characteristics of calculi in the urinary tract.
19. Define common disorders and abnormalities of the urinary system.

Application: What the student should be able to do

20. Practice critical thinking: investigate treatment options for end-stage renal disease. (Assignment Sheet 1)

Module 14: Reproductive System—Male

Related information: What the student should know

1. Define the term *male reproductive system.*
2. State the functions of the male reproductive system.

Module 14: Reproductive System—Male (cont.)

Related information: What the student should know (cont.)

3. Define the term *semen.*
4. Define the major glands and structures of the male reproductive system.
5. Label the major glands and structures of the male reproductive system.
6. Complete statements that describe the characteristics and structure of the scrotum.
7. Complete statements that describe the characteristics and structure of the testes.
8. Complete statements that describe the characteristics and structure of the epididymis.
9. Complete statements that describe the characteristics and structure of the vas deferens.
10. Complete statements that describe the characteristics and structure of the seminal vesicles.
11. Complete statements that describe the characteristics and structure of the prostate gland.
12. Complete statements that describe the characteristics and structure of the bulbourethral glands.
13. Complete statements that describe the characteristics and structure of the penis.
14. Describe the stages of development of the male reproductive organs.
15. Match common disorders and abnormalities of the male reproductive system to their correct definitions.

Application: What the student should be able to do

16. Practice critical thinking: investigate a topic related to male sexual dysfunction. (Assignment Sheet 1)

Module 15: Reproductive System—Female

Related information: What the student should know

1. Define the term *female reproductive system.*
2. Define the term *ovum.*
3. Define the term *fertilization.*
4. State the functions of the female reproductive system.
5. List the major divisions of the female reproductive system.
6. Define the major organs and structures of the internal female reproductive system.
7. Label the major internal organs and structures of the female reproductive system.
8. Complete statements that describe the characteristics and structure of the ovaries.
9. Complete statements that describe the characteristics and structure of the fallopian tubes.

Module 15: Reproductive System—Female (cont.)

Related information: What the student should know (cont.)

10. Complete statements that describe the characteristics and structure of the uterus.
11. Complete statements that describe the characteristics and structure of the vagina.
12. Complete statements that describe the major structures of the external female reproductive system.
13. Label the major structures and substructures of the internal female reproductive system.
14. Label the major structures of the external female reproductive system.
15. Complete statements that describe the characteristics and structure of the breasts.
16. Label the major structures of a female breast.
17. Describe the stages of development of the female reproductive organs.
18. Complete statements that describe menstruation and the menstrual cycle.
19. Define terms associated with irregularities of the menstrual cycle.
20. Define the term *surgical menopause*.
21. Complete statements that describe the characteristics of pregnancy.
22. Complete statements that describe the characteristics of fetal development.
23. Describe the stages of labor and delivery.
24. Define terms that describe types of abnormal deliveries.
25. Complete statements that describe the characteristics of genetics and heredity.
26. Define common disorders and abnormalities of the female reproductive system.

Application: What the student should be able to do

27. Practice critical thinking: complete case studies that evaluate infant health and determine required care. (Assignment Sheet 1)

Academic and Workplace Skill Classifications and Definitions

Skill groups	Sub skills	Definitions
Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
	Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
	Arithmetic/mathematics	Performing basic computations, applying estimating and reasoning skills, and solving practical problems using a variety of mathematical techniques
	Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Listening	Receiving, interpreting, and responding to oral messages and other cues
	Speaking	Communicating a thought, idea, or fact verbally in a clear, concise manner
Thinking skills	Creative thinking	Using imagination to generate new ideas
	Decision making	Specifying goals and constraints, generating alternatives, considering risks, and evaluating and choosing the best alternative
	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
	Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information
	Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
Personal management skills	Responsibility	Exerting a high level of effort towards goal attainment, working hard to become excellent at doing tasks by setting high standards, paying attention to details, and displaying a high level of concentration
	Self-esteem	Developing self-confidence and maintaining a positive self-image
	Career awareness, development, and mobility	Assessing self accurately, setting personal goals, establishing and implementing a plan, and monitoring progress
	Integrity/honesty	Choosing an ethical course of action when faced with making a decision that may break with personal or societal values and recognizing the impact of violating these beliefs and codes on an organization, self, and others
	Organizational effectiveness	Adapting to the organization's goals, values, culture, and traditional modes of operation
Interpersonal skills	Teamwork	Working cooperatively with others to reach a common goal
	Coaching	Helping others learn new skills

Skill groups	Sub skills	Definitions
Interpersonal skills (continued)	Leadership	Communicating ideas to justify position; accepting responsibility for others; and encouraging, persuading, convincing, or otherwise motivating an individual or group
	Negotiation	Resolving conflict between two or more individuals through discussion and compromise
	Customer service	Working and communicating with customers to satisfy their expectations
	Cultural diversity	Working well with men and women and with a variety of ethnic, social, or educational backgrounds
Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
	Organization and storage	Organizing, processing, and maintaining written or computerized records and other forms of information in a systematic way
	Interpretation	Selecting and analyzing information and communicating the results to others
	Processing	Using computers to acquire, organize, analyze, and communicate information
Systems	Interrelationships	Knowing how social, organizational, and technological systems work and operate effectively
	Monitoring	Distinguishing trends, predicting impact of actions on system operations, diagnosing deviations in systems' performance, and correcting malfunctions
	Modification and design	Making suggestions to modify existing systems to improve products or services, and developing new or alternative systems
Technology	Selection	Choosing procedures, tools, or equipment including computers and related technologies
	Application	Demonstrating proper procedures for setting up and operating equipment
	Maintenance and trouble-shooting	Preventing, identifying, or solving problems with equipment, including computers and other technologies
Resources	Time	Selecting relevant, goal-related activities; ranking them in order of importance; allocating time; and understanding, preparing, and following schedules
	Money	Using or preparing budgets, making forecasts, keeping records, and making adjustments to meet objectives
	Material and facilities	Acquiring, storing, and using materials and space efficiently
	Human resources	Assessing skills and distributing work accordingly, evaluating performance and providing feedback

Related Academic and Workplace Skills List

Module 1: Integumentary System			
Practice Critical Thinking: Investigate Skin Cancer (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
Practice Critical Thinking: Investigate Burns (A.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
Module 2: Skeletal System			
Classify Bone Fractures (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task

Module 2: Skeletal System (cont.)

	Thinking skills	Seeing things in the mind's eye	Mentally organizing and processing symbols, pictures, graphs, and other information
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
Practice Critical Thinking: Research the Current Medical Understanding of the Causes and Treatments of Rheumatoid Arthritis (A.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
	Thinking skills	Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 3: Muscular System

Practice Critical Thinking: Determine Common Intramuscular Injection Sites (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Listening	Receiving, interpreting, and responding to oral messages and other cues
	Thinking skills	Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
Practice Critical Thinking: Report on Disorders and Abnormalities of the Muscular System (A.S. 2)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
	Thinking skills	Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy

Module 3: Muscular System (cont.)			
		Interpretation	Selecting and analyzing information and communicating the results to others
Module 4: Nervous System			
Practice Critical Thinking: Investigate Nerve-Block Anesthetics (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
	Thinking skills	Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
Module 5: Endocrine System			
Practice Critical Thinking: Complete Case Studies that Determine Medical Interventions for Endocrine Disorders (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
Module 6: Special Senses			
Practice Critical Thinking: Investigate the Functioning of the Special Senses (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner

Module 6: Special Senses (cont.)

	Thinking skills	Creative thinking	Using imagination to generate new ideas
		Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 7: Circulatory System—Blood

Practice Critical Thinking: Complete Case Studies on the Role of Blood in Maintaining Good Health (A.S. 1)	Basic Skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 8: Circulatory System—Cardiac

Practice Critical Thinking: Describe and Evaluate Types of Cardiac Pacemakers (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner

Module 8: Circulatory System—Cardiac (cont.)

		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 9: Circulatory System—Vascular

Practice Critical Thinking: Determine Cause-and-Effect Relationships Related to the Circulatory System (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 10: Lymphatic System

Practice Critical Thinking: Investigate the Involvement of the Lymphatic System in Interventions for Cancer (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques

Module 10: Lymphatic System (cont.)

	Thinking skills	Creative thinking	Using imagination to generate new ideas
		Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 11: Respiratory System

Practice Critical Thinking: Investigate Lung-Transplant Procedures (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Thinking skills	Creative thinking	Using imagination to generate new ideas
		Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
		Processing	Using computers to acquire, organize, analyze, and communicate information
	Technology	Selection	Choosing procedures, tools, or equipment including computers and related technologies

Module 12: Digestive System

Practice Critical Thinking: Investigate Surgical Requirements for the Digestive System (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Thinking skills	Creative thinking	Using imagination to generate new ideas
		Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 13: Urinary System

Practice Critical Thinking: Investigate Treatment Options for End-Stage Renal Disease (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Science	Applying knowledge learned through study and practice that is based on scientific principles, methods, and techniques
	Thinking skills	Creative thinking	Using imagination to generate new ideas
		Decision making	Specifing goals and constraints, generating alternatives, considering risks, and evaluating and choosing the best alternative
		Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem

Module 13: Urinary System (cont.)

	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others
		Processing	Using computers to acquire, organize, analyze, and communicate information
	Technology	Selection	Choosing procedures, tools, or equipment including computers and related technologies

Module 14: Reproductive System—Male

Practice Critical Thinking: Investigate a Topic Related to Male Sexual Dysfunction (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
	Thinking skills	Creative thinking	Using imagination to generate new ideas
		Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results
		Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
		Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
	Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
		Interpretation	Selecting and analyzing information and communicating the results to others

Module 15: Reproductive System—Female

Practice Critical Thinking: Complete Case Studies that Evaluate Infant Health and Determine Required Care (A.S. 1)	Basic skills	Reading	Comprehending written information and analyzing, summarizing, and applying what has been read to a specific task
		Writing	Communicating a thought, idea, or fact in written form in a clear, concise manner
		Arithmetic/mathematics	Performing basic computations, applying estimating and reasoning skills, and solving practical problems using a variety of mathematical techniques
	Thinking skills	Problem solving	Recognizing and defining problems, devising and implementing a plan of action, and tracking and evaluating results

Module 15: Reproductive System—Female (cont.)

	Knowing how to learn	Using efficient learning techniques to acquire and apply new knowledge and skills
	Reasoning	Applying a rule or principle underlying the relationship between two or more objects when solving a problem
Information	Acquisition and evaluation	Identifying need for data, obtaining it from existing sources or creating it, and evaluating its relevance and accuracy
	Interpretation	Selecting and analyzing information and communicating the results to others

Crosswalk to AST Core Curriculum

This crosswalk aligns the MAVCC module objectives for *Anatomy and Physiology: Module Set I, Introduction to Anatomy and Physiology,* and *Module Set II, Major Body Systems,* to a portion of the content outlines in AST's *Core Curriculum for Surgical Technology.* If a blank appears under the "MAVCC Module Objectives" column, then the area is not covered in this portion of the MAVCC curriculum.

AST Course Outline	MAVCC Module Objectives
II. TERMINOLOGY	
A. Pronunciation and Spelling	
1. Pronunciation key a. vowels b. syllables c. diacritical (phonetic) markings d. primary and secondary accents	✔ **NOTE:** See the pronounciation guides in the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
2. Spelling skills	✔ **NOTE:** See the crossword puzzles in the teacher edition for all the modules in Module Set I and Module Set II.
B. Basic Word Structure	
1. Elements a. prefixes b. suffixes c. root words d. plural forms e. compound words f. combining forms	Module Set I, Module 1: Student Supplement 1—Anatomy and physiology terms; Assignment Sheet 2—Define medical terms ✔ **NOTE:** See the notes and key-term boxes for all the modules in Module Set I and Module Set II.
2. Sets describing a. planes and direction of reference b. size, amount, or number c. time or place d. color or description	Module Set I, Module 1: Student Supplement 1—Anatomy and physiology terms; Assignment Sheet 1—Practice critical thinking: use directional terms to describe surgical incisions; Assignment Sheet 2—Define medical terms ✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.

Module Set II: Major Body Systems

2. Sets describing (cont.) e. relation to body type f. conditions of the body	✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
3. Sets describing a. a state or condition b. a size or amount c. formation of plural d. those that determine parts of speech e. procedures f. chemical compounds	Module Set I, Module 1: Student Supplement 1—Anatomy and physiology terms; Assignment Sheet 2—Define medical terms ✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
4. Sets related to body systems	Module Set I, Module 1: Student Supplement 1—Anatomy and physiology terms; Student Supplement 2—Anatomical terms; Assignment Sheet 2—Define medical terms ✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
5. Sets related to medical specialties a. diagnostic imaging and nuclear medicine b. oncology c. obstetrics d. anesthesiology e. pharmacology f. laboratory g. other	
6. Table of word endings that form plurals	Module Set I, Module 1: Student Supplement 1—Anatomy and physiology terms; Assignment Sheet 2—Define medical terms ✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.

7. Compound words using a. two or more words b. noun, pronoun, or verb	✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
8. Combining forms a. vowels b. consonants c. prefixes	Module Set I, Module 1: Assignment Sheet 2—Define medical terms ✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
C. Abbreviations and Symbols	
1. Abbreviations relating to a. time b. place c. medications/dosage d. body structure/area e. diagnostic tests and data f. condition or diagnosis g. surgical procedures	✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
2. Symbols a. weights/measures b. dosages c. descriptive d. to replace common or frequently used words or terms	✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set I and Module Set II.
D. The Body and Its Systems	
1. Classifications of the body a. organizational structure b. planes and surfaces c. directional aspects	 Module Set I, Module 1: Objectives 9 through 14 Module Set I, Module 1: Objective 3—Label the common body planes Module Set I, Module 1: Objective 4—Match the directional terms used in anatomy to their correct descriptions; Assignment Sheet 1—Use directional terms to describe surgical incisions

1. Classifications of the body (cont.)	
d. positions	Module Set I, Module 1: Objective 2— Define the term *anatomical position*; Objective 6—Describe the body positions
e. anatomic and clinical divisions	Module Set I, Module 1: Objective 13—Match the major organ systems to their correct functions; Objective 14—List the major organs and structures in each of the major organ systems
f. body cavities	Module Set I, Module 1: Objective 8—State the contents of the major body cavities
2. Systems a. integumentary b. skeletal c. muscular d. nervous e. special sense organs f. circulatory and lymphatic g. respiratory h. digestive i. urinary j. reproductive k. endocrine l. immunologic	Module Set I, Module 1: Objective 13—Match the major organ systems to their correct functions; Objective 14—List the major organs and structures in each of the major organ systems ✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set II.
3. For each system a. anatomy terms b. physiology terms c. pathology terms d. diagnostic testing terms e. therapeutic terms	Module Set I, Module 1: Student Supplement 1—Anatomy and physiology terms; Student Supplement 2—Anatomical terms; Assignment Sheet 2—Define medical terms ✔ **NOTE:** See the objectives, notes, and key-term boxes for all the modules in Module Set II.

AST Course Outline	MAVCC Module Objectives
III. ANATOMY AND PHYSIOLOGY	
A. Organization of the Human Body	
1. Body planes a. sagittal b. coronal/frontal c. transverse/cross-sectional d. oblique	Module Set I, Module 1: Objective 3—Label the common body planes
2. Terms of reference a. superior/cephalic b. inferior/caudal c. anterior/ventral d. posterior/dorsal e. medial f. lateral g. proximal h. distal i. deep j. superficial k. internal l. external m. central n. peripheral o. parietal p. visceral	Module Set I, Module 1: Objective 4—Match the directional terms used in anatomy to their correct descriptions; Student Supplement 1—Anatomy and physiology terms; Assignment Sheet 1—Use directional terms to describe surgical incisions ✔ **NOTE:** Objective 4 describes the term *exterior.*

3. General regions a. head (1) cranium (2) face b. trunk (1) neck (2) back (3) chest (thorax) (4) abdomen (5) pelvis (6) perineum c. limbs (1) upper limbs (2) lower limbs	Module Set I, Module 1: Objective 7—List the general regions of the body ✔ **NOTE:** Objective 8 through Objective 11 in Module 1 discuss the specific structures in the general regions of the body.
4. Body organization a. cell types (1) epithelial (2) connective tissue (3) muscle (4) nerve (neurons) b. tissue types (1) epithelial (2) connective (3) muscle (4) nervous c. organs d. systems (1) integumentary (2) skeletal (3) muscular	Module Set I, Module 1: Objective 12—List the major body structures in order of increasing complexity ✔ **NOTE:** The basic types of cells and tissues are discussed in Module Set I, Module 4: Tissues, Membranes, and Wound Healing. Module Set I, Module 1: Objective 13—Match the major organ systems to their correct functions; Objective 14—List the major organs and structures in each of the major organ systems ✔ **NOTE:** Organs and organ systems are also discussed in Objective 19 through Objective 22 in Module Set I, Module 4: Tissues, Membranes, and Wound Healing.

d. systems (cont.)	
(4) nervous	
(5) special sense organs	
(6) circulatory and lymphatic	
(7) respiratory	
(8) digestive	
(9) urinary	
(10) reproductive	
(11) endocrine	
(12) immune	
5. Major closed cavities	
a. thoracic	Module Set I, Module 1: Objective 8—State the contents of the major body cavities
(1) pleural	
(2) pericardial	
(3) mediastinum	
b. abdominopelvic	Module Set I, Module 1: Objective 8—State the contents of the major body cavities; Objective 9—Label the quadrants of the abdominopelvic cavity; Objective 10—Match the major abdominopelvic organs to their correct quadrant locations; Objective 11—Label the regions of the abdomen
c. cranial	Module Set I, Module 1: Objective 8—State the contents of the major body cavities
d. spinal	Module Set I, Module 1: Objective 8—State the contents of the major body cavities
B. Cells	
1. Basic activities	Module Set I, Module 2: Objective 22—State definitions of the basic activities that define life
a. movement	
b. responsiveness	
c. metabolism and growth	
d. reproduction	

2. Cellular functions	
a. movement of substances across cell membranes	Module Set I, Module 2: Objective 31—List the functions of a cell; Objective 32—Define the term *transport*; Objective 33—Distinguish between descriptions of the terms *active transport* and *passive transport*; Objective 34—Match types of passive transport to their correct descriptions; Objective 35—Match types of active transport to their correct descriptions
b. metabolism	Module Set I, Module 2: Objective 31—List the functions of a cell
c. reproduction	Module Set I, Module 2: Objective 37—Describe the types of cell reproduction
3. Basic structure and functions	
a. cell membrane	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
b. cytoplasm	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
c. nucleus	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions; Objective 28—Describe the major parts of a cell nucleus
(1) nuclear membrane	
(2) nucleolus	
(3) chromatin and chromosomes	
d. organelles	
(1) centrosome and centrioles	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
(2) mitochondria	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
(3) ribosomes	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
(4) endoplasmic reticulum: rough and smooth	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
(5) Golgi apparatus	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
(6) vesicles	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions
(7) lysosomes	Module Set I, Module 2: Objective 27—Match the major parts of a cell to their correct functions

d. organelles (cont.)	
(8) cilia or flagella	Module Set I, Module 2: Objective 29—Describe the specialized structures in cells; Objective 30—State the functions of the specialized structures in cells
e. nucleic acids (DNA and RNA)	Module Set I, Module 2: Objective 28—Describe the major parts of a cell nucleus
4. Cell division	
a. DNA replication	Module Set I, Module 2: Objective 36—Complete statements that describe the process of cell growth
b. mitosis (somatic cells)	Module Set I, Module 2: Objective 37—Describe the types of cell reproduction
c. meiosis (sex cells)	Module Set I, Module 2: Objective 37—Describe the types of cell reproduction
5. Cellular respiration	Module Set I, Module 2: Objective 40—Match the types of cellular respiration to their correct descriptions
a. glycolysis	
b. anaerobic oxidation (fermentation)	
c. aerobic oxidation (Krebs cycle)	
C. Tissues	
1. Tissue	Module Set I, Module 4: Objective 1—Define the term *tissue*
a. collection of like cells	
b. common specialized function	
c. cellular attachments	
d. intercellular substances	
2. Types of tissue and functions	Module Set I, Module 4: Objective 2—Match the basic types of tissue to their correct descriptions; Objective 3—State the functions of the basic types of tissue
a. epithelial	
b. connective	
c. muscle	
d. nervous	

3. Tissue structure and location	
a. epithelial tissue	Module Set I, Module 4: Objective 2—Match the basic types of tissue to their correct descriptions
(1) structural characteristics	Module Set I, Module 4: Objective 5—Define the types of epithelial tissue as classified by shape; Objective 6—Define the types of epithelial tissue as classified by tissue-layer arrangement
(a) one layer (simple)	
(b) multilayer (stratified)	
(2) location	Module Set I, Module 4: Objective 4—Complete statements that describe the characteristics of the epithelium; Objective 7—Match the classes of epithelial tissue to their correct functions
(a) covering and lining epithelium	
(b) glandular epithelium	
b. connective tissue	Module Set I, Module 4: Objective 2—Match the basic types of tissue to their correct descriptions
(1) structural characteristics	Module Set I, Module 4: Objective 8—Match the types of connective tissue to their correct functions
(a) cells	
(b) fibers	
(2) classification and location	Module Set I, Module 4: Objective 8—Match the types of connective tissue to their correct functions
(a) loose areolar connective tissue	
(b) dense irregular connective tissue	
(c) dense fibrous connective tissue	
(d) adipose tissue	
(e) cartilage	
(f) bone	
(g) blood and lymph	
c. muscle tissue	Module Set I, Module 4: Objective 2—Match the basic types of tissue to their correct descriptions
(1) skeletal/striated	Module Set I, Module 4: Objective 13—Describe the factors that determine muscle-tissue classifications
(2) visceral/smooth	
(3) cardiac	

d. nervous tissue	Module Set I, Module 4: Objective 2—Match the basic types of tissue to their correct descriptions
(1) types of neurons	Module Set I, Module 4: Objective 11—Complete statements that describe how neurons function in the nervous system
(a) sensory (afferent)	
(b) motor and secretory (efferent)	
(2) types of neuroglia	Module Set I, Module 4: Objective 12—State the functions of the types of neuroglia
4. Muscle contraction	Module Set I, Module 4: Objective 14—Match types of muscle contractions to their correct definitions
a. contractile elements	
b. sliding filament mechanism	Module Set I, Module 4: Objective 16—Complete statements that describe the neuromuscular-excitability response (sliding-filament theory)
5. Neuromuscular excitability (electrophysiology)	Module Set I, Module 4: Objective 15—Define the term *neuromuscular excitability*; Objective 16—Complete statements that describe the neuromuscular-excitability response
a. nerve impulse	
b. neuromuscular junction	
D. Organs	
1. Organ	Module Set I, Module 4: Objective 19—Define the term *organ*
a. interrelated unit	
b. two or more basic tissues	
c. complex structure	
d. specific function(s)	
2. Types of tissues in organs	Module Set I, Module 4: Objective 20—List the types of tissues and membranes found in selected organs
a. heart	
b. stomach	
c. nerves	
d. brain	
e. other	

3. Organ systems activities a. homeostasis b. response to external and internal environment c. exchange of materials d. regulation and feedback mechanisms	Module Set I, Module 4: Objective 21—Complete statements that describe how organ systems function ✔ **NOTE:** Module Set I, Module 2: Objective 3 also defines the term *homeostasis*.
4. Abnormalities a. aplasia b. hypoplasia c. atrophy d. hypertrophy e. hyperplasia f. dysplasia g. anaplasia	Module Set I, Module 4: Objective 22—Match terms that describe abnormalities in organ development to their correct definitions
E. Integumentary System	
1. Functions of skin a. protection b. regulation of body temperature c. prevention of loss of body fluids d. monitoring of external environment e. excretion f. absorption	Module Set II, Module 1: Objective 4—List the functions of the skin
2. Epidermal layers and functions a. outermost stratum b. basal stratum	Module Set II, Module 1: Objective 5—Describe the major structures of the skin; Objective 6—Match the layers of the epidermis to their correct descriptions; Objective 13—Label the major structures of the integument

3. Dermis a. structure b. functions	Module Set II, Module 1: Objective 5—Describe the major structures of the skin; Objective 7—Distinguish between descriptions of the layers of the dermis; Objective 13—Label the major structures of the integument
c. auxiliary structures	Module Set II, Module 1: Objective 8—Define the term *auxiliary appendage*
(1) hair follicles	Module Set II, Module 1: Objective 9—Complete statements that describe the characteristics of hair
(2) nails	Module Set II, Module 1: Objective 10—Complete statements that describe the characteristics of nails
(3) glands	Module Set II, Module 1: Objective 11—State the functions of the glands located in the skin
(4) sensory nerve endings	Module Set II, Module 1: Objective 12—List the types of nerve endings found in the skin ✔ **NOTE:** The structure and functions of the cutaneous nerve endings are discussed in more detail in Module 4, "Nervous System," and in Module 6, "Special Senses."
4. Hypodermis/subcutaneous tissue a. structure b. functions	Module Set II, Module 1: Objective 5—Describe the major structures of the skin; Objective 13—Label the major structures of the integument
F. Skeletal System	
1. Skeletal regions and specific bones a. axial skeleton (80 bones) b. appendicular skeleton (126 bones)	Module Set II, Module 2: Objective 11—Describe the major divisions of the human skeleton; Objective 12—Label the major components of the anterior and posterior axial skeleton; Objective 13—Label the major bones of the anterior and posterior appendicular skeleton
2. Types of bones a. long b. short c. flat d. irregular e. sesamoid	Module Set II, Module 2: Objective 5—Complete statements that describe the types of bones as classified by their location and structure

3. Functions of bone a. framework/support b. protection c. leverage for movement (attachment for muscles) d. storage of calcium e. blood cell production	Module Set II, Module 2: Objective 2—State the functions of the skeletal system
4. Formation of bone a. osteoblasts	Module Set II, Module 2: Objective 5—Complete statements that describe the types of bones as classified by their location and structure
b. osteocytes	Module Set II, Module 2: Objective 3—Distinguish between phrases that describe the characteristics of bone and cartilage
c. osteoclasts	Module Set II, Module 2: Objective 27—Match common disorders and abnormalities of the skeletal system to their correct definitions
d. ossification	
e. haversian system	Module Set II, Module 2: Objective 3—Distinguish between phrases that describe the characteristics of bone and cartilage
f. endochondral bone formation g. intramembranous bone formation h. callus formation	
5. Differences between bone and cartilage a. types b. characteristics c. locations	Module Set II, Module 2: Objective 3—Distinguish between phrases that describe the characteristics of bone and cartilage
6. Structure of long bones a. epiphysis b. diaphysis c. epiphyseal plate/line d. articular cartilage e. cortical (compact) bone	Module Set II, Module 2: Objective 7—Define the major structures of a long bone; Objective 8—Label the major structures of a long bone

6. Structure of long bones (cont.) f. cancellous (spongy) bone g. medullary canal/cavity h. endosteum i. periosteum	Module Set II, Module 2: Objective 7—Define the major structures of a long bone; Objective 8—Label the major structures of a long bone
7. Bone markings and features	
a. projections	Module Set II, Module 2: Objective 10—Define terms that describe the cavities and processes of bones
b. depressions	Module Set II, Module 2: Objective 10—Define terms that describe the cavities and processes of bones
c. articulating surfaces	Module Set II, Module 2: Objective 21—Define the term *articular system*; Objective 22—State the functions of the articular system; Objective 23—Complete statements that describe the major structures and substances of the articular system
8. Vertebral column a. vertebral regions b. parts of a vertebra and their regional characteristics c. intervertebral disk components d. spinal ligaments	Module Set II, Module 2: Objective 17—Define the regions and the major bones and structures of the vertebral column; Objective 18—Label the regions and the major bones and structures of the vertebral column
9. Joints	
a. immovable (synarthrotic)	Module Set II, Module 2: Objective 24—Distinguish among phrases that describe the types of articulations
b. slighty movable (amphiarthrotic)	Module Set II, Module 2: Objective 24—Distinguish among phrases that describe the types of articulations; Objective 25—Describe types of amphiathrosis articulations
c. freely movable (diarthrotic) (1) articular cartilage (2) labrum or meniscus (3) capsule (4) external ligaments (5) intraarticular ligaments (6) synovial membrane	Module Set II, Module 2: Objective 24—Distinguish among phrases that describe the types of articulations; Objective 26—Match types of diathrosis articulations to their correct descriptions

G. Muscular System

	✔ **NOTE:** Basic information on muscle tissue is presented in Module Set I, Module 4, "Tissues, Membranes, and Wound Healing." See Objective 13 through Objective 16. In-depth information is presented in Module Set II, Module 3, "Muscular System."
1. Functions of muscle a. protection b. posture c. heat production	Module Set II, Module 3: Objective 2—State the functions of the muscular system
2. Types of muscle a. skeletal b. cardiac c. smooth	Module Set II, Module 3: Objective 3—Describe the major classifications of muscle tissue
3. Actions of muscle a. flexion b. extension c. abduction d. adduction e. internal/medial rotation f. external/lateral rotation g. elevation h. depression i. supination j. pronation k. protraction l. retraction m. dorsiflexion n. plantar flexion o. inversion p. eversion	Module Set II, Module 3: Objective 9—State the actions performed by the types of muscles as classified by their actions

4. Categories of skeletal muscles	Module Set II, Module 3: Objective 10—Define terms that describe how muscles function during coordinated movement
a. agonist/prime mover	
b. antagonist	
c. synergist	
d. fixator	
5. Terminology for skeletal muscle	
a. muscle belly	Module Set II, Module 3: Objective 4—Define the major structures of skeletal muscles; Objective 5—Label the major structures of skeletal muscles
b. tendon	Module Set II, Module 3: Objective 6—Complete statements that describe the characteristics of the bone/muscle attachments of skeletal muscles
c. origin-insertion	Module Set II, Module 3: Objective 4—Define the major structures of skeletal muscles; Objective 5—Label the major structures of skeletal muscles
d. fascia	Module Set I, Module 4: Objective 8—Match types of connective tissue to their correct functions; Objective 17—State the locations of the main types of membranes
e. bursa	Module Set I, Module 4: Objective 8—Match types of connective tissue to their correct functions; Objective 17—State the locations of the main types of membranes
f. muscle tone	Module Set II, Module 3: Objective 8—Define terms that describe the functional characteristics of muscle tissue
g. twitch contraction	✔ **NOTE:** See the definitions of the terms *cramps*, *convulsions*, and *fibrillation* in Module Set II, Module 3: Objective 20—Match common disorders and abnormalities of the muscular system to their correct definitions.
h. spasm	✔ **NOTE:** See the definition of the term *fibrillation* in Module Set II, Module 3: Objective 20—Match common disorders and abnormalities of the muscular system to their correct definitions.
i. summation	
j. tetanus	Module Set II, Module 3: Objective 20—Match common disorders and abnormalities of the muscular system to their correct definitions
k. fatigue	
l. other	

6. Name, location, and actions of major muscles	Module Set II, Module 3: Objective 11—State the functions of the major muscle groups
a. face and head	Module Set II, Module 3: Objective 12—State the functions of the major muscles of the neck, head, and face; Objective 13—Label the major muscles of the neck, head, and face
(1) muscles of facial expression	
(2) scalp muscles	
(3) muscles of mastication	
b. neck	Module Set II, Module 3: Objective 12—State the functions of the major muscles of the neck, head, and face; Objective 13—Label the major muscles of the neck, head, and face
(1) sternocleidomastoid	
(2) platysma	
(3) suprahyoids	
(4) infrahyoids	
c. back	
(1) trapezius	Module Set II, Module 3: Objective 12—State the functions of the major muscles of the neck, head, and face; Objective 13—Label the major muscles of the neck, head, and face
(2) latissimus dorsi	Module Set II, Module 3: Objective 14—State the functions of the major muscles of the torso; Objective 15—Label the major muscles of the torso
(3) erector spinae	
d. shoulder	Module Set II, Module 3: Objective 14—State the functions of the major muscles of the torso; Objective 15—Label the major muscles of the torso
(1) deltoid	
(2) rotator cuff components	
e. arm	Module Set II, Module 3: Objective 16—State the functions of the major muscles of the arms; Objective 17—Label the major muscles of the arms
(1) biceps brachii	
(2) triceps brachii	
f. forearm	Module Set II, Module 3: Objective 16—State the functions of the major muscles of the arms; Objective 17—Label the major muscles of the arms
(1) flexors	
(2) extensors	

6. Name, location, and actions of major muscles (cont.)	
g. chest wall	Module Set II, Module 3: Objective 14—State the functions of the major muscles of the torso; Objective 15—Label the major muscles of the torso
(1) pectoralis major	
(2) pectoralis minor	
(3) intercostals	
h. diaphragm	Module Set II, Module 3: Objective 14—State the functions of the major muscles of the torso; Objective 15—Label the major muscles of the torso
i. abdominal wall	Module Set II, Module 3: Objective 14—State the functions of the major muscles of the torso; Objective 15—Label the major muscles of the torso
(1) external oblique	
(2) internal oblique	
(3) transversus abdominis	
(4) rectus abdominis	
j. thigh	Module Set II, Module 3: Objective 18—State the functions of the major muscles of the legs; Objective 19—Label the major muscles of the legs
(1) iliopsoas	
(2) quadriceps femoris (rectus femoris and vasti)	
(3) sartorius	
(4) adductor group	
(5) hamstrings (biceps femoris)	
(6) gluteal muscles (gluteus maximus, medius, and minimus)	
k. leg	Module Set II, Module 3: Objective 18—State the functions of the major muscles of the legs; Objective 19—Label the major muscles of the legs
(1) gastrocnemius	
(2) soleus	
(3) plantaris	
(4) extensors	
(5) peroneus longus and brevis	

H. Nervous System

	✔ **NOTE:** Basic information on nerve tissue is presented in Module Set I, Module 4, "Tissues, Membranes, and Wound Healing." See Objective 9 through Objective 12. In-depth information on the nervous system is presented in Module Set II, Module 4.
1. Parts of a neuron and their functions a. dendrites b. cell body c. axon d. myelin e. Schwann cells f. neurilemma	Module Set II, Module 4: Objective 6—Define the term *nerve tissue*; Objective 7—Define the basic types of nerve tissue; Objective 8—State the functions of the major structures of a neuron; Objective 9—Label the major structures of a neuron; Objective 10—Define the term *nerve fiber*; Objective 11—Define the major structures of a nerve fiber; Objective 12—Label the major structures of a nerve fiber; Objective 13—Match types of neurons to their correct descriptions
2. Major divisions of the nervous system a. central nervous system (CNS) (1) brain (2) spinal cord	Module Set II, Module 4: Objective 3—Describe the major subsystems of the nervous system
b. peripheral nervous system (PNS) (1) cranial nerves (2) spinal nerves (3) autonomic nervous system (ANS)	Module Set II, Module 4: Objective 3—Describe the major subsystems of the nervous system; Objective 4—Describe the major subsystems of the peripheral nervous system; Objective 5—Describe the major subsystems of the autonomic nervous system
3. Terminology for the central nervous system a. nucleus	✔ **NOTE:** Objective 11 and Objective 12 in Module 4 of Module Set II describe the nucleus of a Schwann cell.
b. tract	
c. gray matter	Module Set II, Module 4: Objective 15—Complete statements that describe a reflex arc
d. white matter	Module Set II, Module 4: Objective 10—Define the term *nerve fiber*
e. other	

4. Major divisions and functions of the brain	Module Set II, Module 4: Objective 24—Define the primary divisions of the brain
a. parts of the brain	
(1) cerebrum	Module Set II, Module 4: Objective 26—Define the major structures of the forebrain and the hindbrain; Objective 27—Label the major structures of the forebrain and the hindbrain; Objective 29—Define the lobes of the cerebrum; Objective 30—Define the fissures of the cerebrum; Objective 31—Label the visible lobes and fissures of the cerebrum
(a) hemispheres	Module Set II, Module 4: Objective 28—Define the terms *hemisphere, sulcus, fissure, lobe,* and *ventricle*
(b) fissures	Module Set II, Module 4: Objective 28—Define the terms *hemisphere, sulcus, fissure, lobe,* and *ventricle*; Objective 30—Define the fissures of the cerebrum; Objective 31—Label the visible lobes and fissures of the cerebrum
(c) lobes	Module Set II, Module 4: Objective 28—Define the terms *hemisphere, sulcus, fissure, lobe,* and *ventricle*; Objective 29—Define the lobes of the cerebrum; Objective 31—Label the visible lobes and fissures of the cerebrum
(2) diencephalon	Module Set II, Module 4: Objective 26—Define the major structures of the forebrain and the hindbrain; Objective 27—Label the major structures of the forebrain and the hindbrain
(a) thalamus	
(b) hypothalamus	
(3) brain stem	Module Set II, Module 4: Objective 26—Define the major structures of the forebrain and the hindbrain; Objective 27—Label the major structures of the forebrain and the hindbrain
(a) midbrain	
(b) pons	
(c) medulla oblongata	
(4) cerebellum	Module Set II, Module 4: Objective 26—Define the major structures of the forebrain and the hindbrain; Objective 27—Label the major structures of the forebrain and the hindbrain
b. coverings of the brain and cord: meninges	Module Set II, Module 4: Objective 19—List the major structures within the spinal canal; Objective 23—Define the major structures of the meninges
(1) dura mater	
(2) arachnoid	
(3) pia mater	

4. Major divisions and functions of the brain (cont.) c. ventricular system (1) ventricles and their connections (2) production and circulation of cerebrospinal fluid d. venous sinuses	Module Set II, Module 4: Objective 21—State the function of cerebrospinal fluid; Objective 22—List the components of cerebrospinal fluid; Objective 33—Complete statements that describe the structure and functioning of the ventricles of the brain; Objective 34—Label the ventricles of the brain and the horns of the lateral ventricles
5. Cranial nerves a. olfactory: I b. optic: II c. oculomotor: III d. trochlear: IV e. trigeminal: V f. abducens: VI g. facial: VII h. vestibulocochlear/auditory/acoustic: VIII i. glossopharyngeal: IX j. vagus: X k. accessory/spinal accessory: XI l. hypoglossal: XII	Module Set II, Module 4: Objective 35—State the number and functions of the cranial nerves of the peripheral nervous system
6. Spinal cord a. functions b. external features (1) meninges (2) vertebral segments (regions) (3) conus medullaris (4) cauda equina	Module Set II, Module 4: Objective 19—List the major structures within the spinal canal; Objective 20—Complete statements that describe the structure and functioning of the spinal cord; Objective 23—Define the major structures of the meninges

6. Spinal cord (cont.) (5) nerve roots (6) sympathetic trunk and ganglia	Module Set II, Module 4: Objective 19—List the major structures within the spinal canal; Objective 20—Complete statements that describe the structure and functioning of the spinal cord; Objective 23—Define the major structures of the meninges
7. Peripheral nervous system a. cranial nerves: 12 pairs (1) afferent: somatic, visceral (2) efferent: visceral	Module Set II, Module 4: Objective 35—State the number and functions of the cranial nerves of the peripheral nervous system
b. spinal nerves: 31 pairs (1) afferent: somatic, visceral (2) efferent: somatic, visceral	Module Set II, Module 4: Objective 38—Describe the number and origin of the spinal nerves; Objective 39—List the major nerves that arise from each plexus
8. Spinal nerve plexuses a. cervical plexus (1) phrenic nerve b. brachial plexus (1) axillary nerve (2) radial nerve (3) median nerve (4) ulnar nerve c. lumbosacral plexus (1) sciatic nerve	Module Set II, Module 4: Objective 36—Define the term *plexus*; Objective 37—Label the plexuses of the spinal cord; Objective 38—Describe the number and origin of the spinal nerves; Objective 39—List the major nerves that arise from each plexus
9. Autonomic nervous system (ANS) a. functional component of the PNS, not a discrete structure	Module Set II, Module 4: Objective 4—Describe the major subsystems of the peripheral nervous system
b. involuntary or visceral regulation	Module Set II, Module 4: Objective 4—Describe the major subsystems of the peripheral nervous system
c. sympathetic division	Module Set II, Module 4: Objective 5—Describe the major subsystems of the autonomic nervous system (ANS)
d. parasympathetic division	Module Set II, Module 4: Objective 5—Describe the major subsystems of the autonomic nervous system (ANS)

10. Synapse a. structure b. neurotransmitters c. breakdown of neurotransmitters	Module Set II, Module 4: Objective 14—Complete statements that describe the transmission of nerve impulses
I. Special Senses	
1. Special senses	Module Set II, Module 6: Objective 1—Define the term *special sense*; Objective 3—Define the major special senses; Objective 4—Define other senses that may also be associated with the special senses
a. visual	✔ **NOTE:** See the objectives listed in #2 below.
b. auditory	✔ **NOTE:** See the objectives listed in #3 below.
c. olfactory	Module Set II, Module 6: Objective 19—Complete statements that describe the sensory response for the sense of smell; Objective 23—Label the major structures of the nose and mouth associated with the senses of smell and taste
d. gustatory	Module Set II, Module 6: Objective 21—Complete statements that describe the sensory response for the sense of taste; Objective 23—Label the major structures of the nose and mouth associated with the senses of smell and taste
2. Eye a. bony socket in skull b. extraocular muscles c. lacrimal apparatus d. eyeball/globe (1) conjunctiva (2) layers (3) lens (4) intrinsic muscles (5) cornea (6) chambers of the eye (7) fluids (8) optic nerve	Module Set II, Module 6: Objective 5—Define the major layers and cavities of the eye; Objective 6—Complete statements that describe the major muscles of the eye; Objective 7—Define the major structures of the eye; Objective 8—Label the major structures of the eye; Objective 9—Complete statements that describe the sensory response for vision; Objective 10—Define the accessory structures of the eye

2. Eye (cont.) e. photoreception (1) refractive media (2) accommodation (3) light regulation (4) photoreceptors (5) fovea centralis (6) optic disc (7) brain pathways	Module Set II, Module 6: Objective 5—Define the major layers and cavities of the eye; Objective 6—Complete statements that describe the major muscles of the eye; Objective 7—Define the major structures of the eye; Objective 8—Label the major structures of the eye; Objective 9—Complete statements that describe the sensory response for vision; Objective 10—Define the accessory structures of the eye
3. Ear a. external ear b. middle ear (tympanic cavity) c. internal ear (labyrinth)	Module Set II, Module 6: Objective 12—Define the major sections of the ear
d. physiology of hearing (1) sound wave reception (2) bone conduction (3) fluid conduction (4) nerve conduction	Module Set II, Module 6: Objectve 13—Describe the conduction used to transmit sound within the ear; Objective 14—Define the major structures of the ear that function in sound transmission (hearing); Objective 16—Describe the function of the branches of the acoustic nerve; Objective 17—Label the major sections and structures of the ear
e. balance/equilibrium (1) semicircular canals and vestibule (2) vestibular nerve	Module Set II, Module 6: Objective 15—Define the major structures of the ear that function to maintain equilibrium; Objective 16—Describe the function of the branches of the acoustic nerve; Objective 17—Label the major sections and structures of the ear
J. Circulatory System—Blood	
1. Components of blood a. formed elements b. plasma and components	Module Set II, Module 7: Objective 5—Define the major components of blood; Objective 7—List the major components of blood plasma

2. Functions of blood	✔ **NOTE:** Basic information about the connective tissues—including blood—is presented in Module Set I, Module 4, "Tissues, Membranes, and Wound Healing."
a. transportation of oxygen, nutrients, and wastes	
b. protection (immune system)	
c. clotting mechanism	
d. acid-base (pH) buffers	
3. Structure and function of formed elements	
a. red blood cells (erythrocytes)	Module Set II, Module 7: Objective 5—Define the major components of blood; Objective 8—Complete statements that describe the characteristics of erythrocytes
b. white blood cells (leukocytes)	Module Set II, Module 7: Objective 5—Define the major components of blood; Objective 9—Complete statements that describe the characteristics of leukocytes
c. platelets (thrombocytes)	Module Set II, Module 7: Objective 5—Define the major components of blood; Objective 10—Complete statements that describe the characteristics of thrombocytes
4. Terminology for hematology	Module Set II, Module 7: Objective 11—Define the term *hematology*
a. red blood cell count	Module Set II, Module 7: Objective 12—Define common tests used in hematologic studies; Objective 13—State the normal parameters of the common tests used in hematologic studies
b. hemoglobin	Module Set II, Module 7: Objective 12—Define common tests used in hematologic studies; Objective 13—State the normal parameters of the common tests used in hematologic studies
c. hematocrit	Module Set II, Module 7: Objective 12—Define common tests used in hematologic studies; Objective 13—State the normal parameters of the common tests used in hematologic studies
d. white blood cell count	Module Set II, Module 7: Objective 12—Define common tests used in hematologic studies; Objective 13—State the normal parameters of the common tests used in hematologic studies
e. differential white count	
f. platelet count	Module Set II, Module 7: Objective 12—Define common tests used in hematologic studies; Objective 13—State the normal parameters of the common tests used in hematologic studies

4. Terminology for hematology (cont.)	
g. coagulation studies	
h. electrolyte studies	Module Set I, Module 2: Objective 16—Define the term *electrolyte*; Objective 17—Discuss the role of electrolytes in human health
i. arterial blood gases (ABGs)	
j. serologic studies	
k. other	
5. Blood types	Module Set II, Module 7: Objective 15—Complete statements that describe the characteristics of the human blood groups (blood types); Objective 16—Describe the factors that must be considered when blood is matched for a transfusion
a. antigen types	
b. antibodies in serum	
c. type and crossmatching	
d. complications of blood transfusion	
6. Rh factor	Module Set II, Module 7: Objective 14—Complete statements that describe the characteristics of the Rh blood-group factor; Objective 16—Describe the factors that must be considered when blood is matched for a transfusion
a. Rh positive	
b. Rh negative	
c. implications in pregnancy	
K. Crculatory System—Cardiac	
1. Terminology for cardiovascular function	
a. heart rate/pulse rate	Module Set II, Module 9: Objective 19: Define the term *pulse point*; Objective 20—State the normal pulse rate of a healthy adult at rest; Objective 21—Label the common pulse points; Objective 24—Describe the factors that affect blood pressure
b. stroke volume	
c. cardiac output	Module Set II, Module 9: Objective 24—Describe the factors that affect blood pressure
d. blood pressure	Module Set II, Module 9: Objective 22—Define the term *blood pressure*; Objective 23—Complete statements that describe how blood pressure is measured; Objective 24—Describe the factors that affect blood pressure
e. normal sinus rhythm	
f. tachycardia	Module Set II, Module 8: Objective 17—Match common disorders and abnormalities of the heart to their correct definitions
g. bradycardia	Module Set II, Module 8: Objective 17—Match common disorders and abnormalities of the heart to their correct definitions

1. Terminology for cardiovascular function (cont.)	
h. fibrillation	Module Set II, Module 8: Objective 17—Match common disorders and abnormalities of the heart to their correct definitions
i. ectopic beat	✔ **NOTE:** See the definitions of the various types of irregular heart beats in Module Set II, Module 8, Objective 17.
j. infarction	Module Set II, Module 8: Objective 17—Match common disorders and abnormalities of the heart to their correct definitions
k. heart block	✔ **NOTE:** See the definition of *atherosclerosis* in Module Set II, Module 8, Objective 17.
l. other	
2. Anatomic structures of the heart	Module Set II, Module 8: Objective 9—Label the major structures of the heart
a. layers	Module Set II, Module 8: Objective 4—Define the tissue layers of the heart
b. chambers	Module Set II, Module 8: Objective 5—Complete statements that describe the characteristics of the chambers of the heart
c. valves	Module Set II, Module 8: Objective 8—Complete statements that describe the characteristics of the major valves of the heart
d. venae cavae	Module Set II, Module 8: Objective 6—Complete statements that describe the characteristics of the major veins of the heart
e. pulmonary veins and arteries	Module Set II, Module 8: Objective 6—Complete statements that describe the characteristics of the major veins of the heart; Objective 7—Complete statements that describe the characteristics of the major arteries of the heart
f. aorta	Module Set II, Module 8: Objective 7—Complete statements that describe the characteristics of the major arteries of the heart
g. coronary arteries and veins	Module Set II, Module 8: Objective 12—Complete statements that describe the characteristics of the coronary arteries and veins
3. Location and position of the heart	Module Set II, Module 8: Objective 2—Complete statements that describe the size and position of the heart
a. mediastinum	
b. apex	

4. Flow of blood a. atrial contraction b. ventricular contraction c. relaxation	Module Set II, Module 8: Objective 10—Define the term *cardiopulmonary circulation*; Objective 11—Arrange in order the sequence of blood flow in cardiopulmonary circulation
5. Heart sound source a. first heart sound b. second heart sound	Module Set II, Module 8: Objective 16—Define the sounds of a heartbeat
6. Regulating mechanisms of heart rate a. autorhythmicity b. autonomic regulation	
7. Conductile pathway of the heart a. sinoatrial node (pacemaker of the heart) b. atrial myocardium c. atrioventricular node d. bundle of His and bundle branches e. Purkinje fibers f. ventricular myocardium	Module Set II, Module 8: Objective 13—Define the term *conduction system of the heart*; Objective 14—Define the major structures of the conduction system of the heart; Objective 15—State the sequence for the conduction of a contraction of the heart in a heartbeat
L. Circulatory System—Vascular	
1. Types of blood vessels a. large arteries b. small arteries c. arterioles d. capillaries e. venules f. small veins g. large veins	Module Set II, Module 9: Objective 1—Define the term *vascular system*; Objective 2—List the major structures of the vascular system; Objective 7—Complete statements that describe the characteristics of arteries; Objective 11—Complete statements that describe the characteristics of capillaries; Objective 14—Complete statements that describe the characteristics of veins ✔ **NOTE:** See also Module Set II, Module 7: Objective 4—Match the major organs of the circulatory system to their correct definitions—for definitions of the terms *arteries, veins, capillaries, arterioles,* and *venules.*

2. Structure of each type a. adventitia b. media c. intima d. valves	Module Set II, Module 9: Objective 5—Define the tissue layers of an artery; Objective 6—Label the tissue layers of an artery; Objective 12—Define the tissue layers of a vein; Objective 13—Label the tissue layers of a vein
3. Major systemic arteries a. aortic arch b. brachiocephalic c. common carotid (1) external carotid (2) internal carotid (3) circle of Willis d. subclavian (1) vertebral (2) internal thoracic/mammary e. axillary f. brachial g. radial and ulnar h. thoracic aorta (1) intercostals i. abdominal aorta j. celiac trunk/axis k. gastric l. splenic m. hepatic n. superior mesenteric o. renal p. gonadal	Module Set II, Module 9: Objective 8—Complete statements that describe the characteristics of the aorta in the systemic arterial circulation system; Objective 9—Define the major arteries that extend from the aorta; Objective 10—Label the major arteries of the systemic circulation system

3. Major systemic arteries (cont.) q. inferior mesenteric r. common iliac (1) internal iliac (2) external iliac s. femoral (1) superficial (2) deep (profunda) t. popliteal u. posterior tibial (1) peroneal v. anterior tibial w. dorsalis pedis	Module Set II, Module 9: Objective 8—Complete statements that describe the characteristics of the aorta in the systemic arterial circulation system; Objective 9—Define the major arteries that extend from the aorta; Objective 10—Label the major arteries of the systemic circulation system
4. Major systemic veins a. veins corresponding to arteries in No. 3 b. inferior vena cava c. superior vena cava d. cranial venous sinuses e. internal jugular f. azygos system g. portal h. superficial system, upper limb (1) cephalic (2) basilic i. superficial system, lower limb (1) greater saphenous (2) lesser saphenous	Module Set II, Module 9: Objective 15—Define the major veins of the systemic circulation system; Objective 16—Label the major veins of the systemic circulation system; Objective 17—Define the term *portal circulation system*; Objective 18—Complete statements that describe the characteristics of the portal circulation system

5. Fetal circulation a. placenta b. umbilical vein c. ductus venosus d. foramen ovale e. ductus arteriosus f. umbilical arteries	Module Set II, Module 9: Objective 25—Complete statements that describe the characteristics of the fetal circulation system
6. Pulse points a. carotid b. radial c. brachial d. facial e. superficial temporal f. femoral g. dorsalis pedis h. posterior tibial	Module Set II, Module 9: Objective 19—Define the term *pulse point*; Objective 20—State the normal pulse rate of a healthy adult at rest; Objective 21—Label the common pulse points
7. Factors that affect blood pressure a. cardiac output b. peripheral vascular resistance (vasoconstriction or dilatation) c. elasticity of arteries d. blood volume e. blood viscosity f. other	Module Set II, Module 9: Objective 24—Describe the factors that affect blood pressure
M. Lymphatic System	
1. Types of locations of lymphoid tissue	Module Set II, Module 10: Objective 2—List the major structures of the lymphatic system; Objective 3—Label the major structures of the lymphatic system
a. types of tonsils	Module Set II, Module 10: Objective 16—Complete statements that describe the characteristics of the tonsils; Objective 17—Label the tonsils of the mouth and throat

1. Types of locations of lymphoid tissue (cont.)	
b. thymus	Module Set II, Module 10: Objective 15—Complete statements that describe the characteristics of the thymus
c. spleen	Module Set II, Module 10: Objective 14—Complete statements that describe the characteristics of the spleen
d. Peyer's patches	Module Set II, Module 10: Objective 16—Complete statements that describe the characteristics of the tonsils
e. regional lymph nodes	Module Set II, Module 10: Objective 8—Complete statements that describe the characteristics of lymph nodes; Objective 9—Define the major groups of lymph nodes; Objective 10—Label the major groups of lymph nodes ✓ **NOTE:** See also Module Set II, Module 7: Objective 3—List the subsystems of the circulatory system; and Objective 4—Match the major organs of the circulatory system to their correct definitions.
2. Functions of lymph glands a. filter lymph fluid b. produce T and B lymphocytes c. produce monocytes d. antibody formation e. special functions of spleen	Module Set II, Module 10: Objective 8—Complete statements that describe the characteristics of lymph nodes; Objective 14—Complete statements that describe the characteristics of the spleen; Objective 15—Complete statements that describe the characteristics of the thymus; Objective 16—Complete statements that describe the characteristics of the tonsils
3. Lymph fluid	
a. composition	Module Set II, Module 10: Objective 5—Complete statements that describe the characteristics of lymph and its movement through the body
b. drainage pathways	Module Set II, Module 10: Objective 4—State the sequence of lymph circulation through the major structures of the lymphatic system; Objective 5—Complete statements that describe the characteristics of lymph and its movement through the body; Objective 6—Complete statements that describe the characteristics of lymphatic capillaries; Objective 7—Complete statements that describe the characteristics of lymphatic vessels; Objective 11—Define the major lymphatic ducts; Objective 12—Label the major lymphatic ducts

4. Lymph ducts a. thoracic duct b. right lymphatic duct	Module Set II, Module 10: Objective 11—Define the major lymphatic ducts; Objective 12—Label the major lymphatic ducts
5. Edema a. definition b. causes	Module Set II, Module 10: Objective 18—Define common disorders and abnormalities of the lymphatic system
N. Respiratory System	
1. Respiratory pathway	Module Set II, Module 11: Objective 5—Define the major organs and structures of the respiratory system; Objective 6—Label the major organs and structures of the respiratory system
a. nares b. nasal cavity c. choanae	Module Set II, Module 11: Objective 7—Complete statements that describe the characteristics and structures of the nose that are related to the respiratory system
d. nasopharynx	Module Set II, Module 11: Objective 8—Complete statements that describe the characteristics of the pharynx that are related to the respiratory system
e. oropharynx	Module Set II, Module 11: Objective 8—Complete statements that describe the characteristics of the pharynx that are related to the respiratory system
f. laryngopharynx	Module Set II, Module 11: Objective 8—Complete statements that describe the characteristics of the pharynx that are related to the respiratory system
g. larynx	Module Set II, Module 11: Objective 9—Complete statements that describe the characteristics and structures of the larynx that are related to the respiratory system
h. trachea	Module Set II, Module 11: Objective 10—Complete statements that describe the characteristics and structures of the trachea
i. primary bronchi	Module Set II, Module 11: Objective 11—Complete statements that describe the characteristics and structures of the bronchi; Objective 12—Label the major structures of the bronchi

1. Respiratory pathway (cont.)	
j. secondary bronchi	Module Set II, Module 11: Objective 11—Complete statements that describe the characteristics and structures of the bronchi; Objective 12—Label the major structures of the bronchi
k. bronchioles	Module Set II, Module 11: Objective 11—Complete statements that describe the characteristics and structures of the bronchi; Objective 12—Label the major structures of the bronchi
l. alveolar ducts	Module Set II, Module 11: Objective 11—Complete statements that describe the characteristics and structures of the bronchi; Objective 12—Label the major structures of the bronchi
m. alveoli	Module Set II, Module 11: Objective 11—Complete statements that describe the characteristics and structures of the bronchi; Objective 12—Label the major structures of the bronchi
n. pulmonary capillaries	Module Set II, Module 11: Objective 11—Complete statements that describe the characteristics and structures of the bronchi; Objective 12—Label the major structures of the bronchi
2. Physiology of respiratory pathway a. characteristics of aforementioned structures b. functions of aforementioned structures	✔ **NOTE:** See the objectives that pertain to #1 above.
3. Lung units a. hilum b. lobes c. bronchopulmonary segments d. right and left sides	Module Set II, Module 11: Objective 13—Complete statements that describe the characteristics and structures of the lungs; Objective 14—Label the major external structures of the lungs
4. Pleural space a. parietal pleura b. visceral pleura c. pleural recesses d. pleural fluid	Module Set II, Module 11: Objective 15—Complete statements that describe the characteristics and structures of the pleura; Objective 16—Label the major structures of the pleura

5. Mechanisms of inspiration and expiration a. nervous control (1) medullary respiratory center (2) phrenic and intercostal nerves (3) vagus nerves	Module Set II, Module 11: Objective 17—Complete statements that describe the muscles that change the size of the thorax
b. chemical control (1) carbon dioxide (2) oxygen	✔ **NOTE:** Basic information about the role of chemistry in human health is presented in Module Set I, Module 2: Biochemistry and Microbiology.
c. diaphragm in inspiration and expiration	Module Set II, Module 11: Objective 17—Complete statements that describe the muscles that change the size of the thorax
d. intercostal muscles in inspiration and expiration	Module Set II, Module 11: Objective 17—Complete statements that describe the muscles that change the size of the thorax
e. changes in intrapleural pressures	
f. changes in intrapulmonic (lung) pressures	
6. Terminology for respiratory volume a. tidal volume b. vital capacity c. inspiratory reserve d. expiratory reserve e. residual volume f. total capacity g. other	Module Set II, Module 11: Objective 3—Define terms used to measure the various aspects of respiratory volume
7. Terminology for breathing abnormalities a. hyperventilation (1) tachypnea (2) hyperpnea b. apnea	Module Set II, Module 11: Objective 18—Match common disorders and abnormalities of the respiratory system to their correct definitions

7. Terminology for breathing abnormalities (cont.) c. dyspnea d. hypoxia e. hypercapnea f. cyanosis g. Cheyne-Stokes respiration h. other	Module Set II, Module 11: Objective 18—Match common disorders and abnormalities of the respiratory system to their correct definitions
O. Digestive System	
1. Anatomic pathway a. mouth b. pharynx c. esophagus d. stomach e. small intestine f. large intestine/colon g. rectum h. anus	Module Set II, Module 12: Objective 3—Define the term *alimentary tract*; Objective 4—Define the organs and structures of the alimentary tract; Objective 7—Label the major organs and structures of the digestive system
2. Abdominal cavity features a. peritoneum (1) parietal (2) visceral (3) peritoneal cavity (4) retroperitoneal space b. peritoneal duplications (1) greater omentum (2) lesser omentum (3) omental bursa (4) mesentery (5) mesocolon	

3. Layers of digestive tube wall a. mucosa b. submucosa c. muscularis d. serosa	Module Set II, Module 12: Objective 18—Complete statements that describe the characteristics and functions of the stomach
4. Alimentary tract/canal	
a. mouth/oral cavity	
(1) hard palate	Module Set II, Module 12: Objective 8—Complete statements that describe the characteristics and structures of the mouth; Objective 9—Label the major structures of the mouth
(2) soft palate and uvula	Module Set II, Module 12: Objective 8—Complete statements that describe the characteristics and structures of the mouth; Objective 9—Label the major structures of the mouth
(3) tongue	Module Set II, Module 12: Objective 8—Complete statements that describe the characteristics and structures of the mouth; Objective 9—Label the major structures of the mouth
(4) salivary glands	Module Set II, Module 12: Objective 8—Complete statements that describe the characteristics and structures of the mouth; Objective 9—Label the major structures of the mouth
(5) teeth	Module Set II, Module 12: Objective 10—Complete statements that describe the characteristics and structures of the teeth; Objective 11—Label the major structures of a tooth; Objective 12—Define the types of teeth as classified by location and function; Objective 13—Label the types of teeth as classified by location and function
b. pharynx	Module Set II, Module 12: Objective 14—Complete statements that describe the characteristics and structures of the pharynx that relate to the digestive system
c. esophagus	Module Set II, Module 12: Objective 15—Complete statements that describe the characteristics and structures of the esophagus
d. stomach (1) structure and location (2) functions	Module Set II, Module 12: Objective 16—Define the major structures of the stomach; Objective 17—Label the major structures of the stomach; Objective 18—Complete statements that describe the characteristics and functions of the stomach

4. Alimentary tract/canal (cont.)	
e. small intestine	Module Set II, Module 12: Objective 19—Define the major structures of the small intestine; Objective 20—Complete statements that describe the characteristics and functions of the small intestine
(1) structure and location	
(2) functions	
f. large intestine	Module Set II, Module 12: Objective 21—Define the major structures of the large intestine; Objective 22—Define the sections and flexures of the colon; Objective 23—Label the major structures of the large intestine; Objective 24—Complete statements that describe the characteristics and functions of the large intestine
(1) structure and location	
(2) functions	
g. anal canal	Module Set II, Module 12: Objective 21—Define the major structures of the large intestine; Objective 23—Label the major structures of the large intestine
(1) structure and location	
(2) functions	
5. Accessory digestive structures	Module Set II, Module 12: Objective 5—Define the term *accessory glands*; Objective 6—Define the accessory glands of the digestive system
a. salivary glands	Module Set II, Module 12: Objective 8—Complete statements that describe the characteristics and structures of the mouth; Objective 9—Label the major structures of the mouth
(1) structure and location	
(2) functions	
b. liver	Module Set II, Module 12: Objective 7—Label the major organs and structures of the digestive system; Objective 25—Complete statements that describe the characteristics and structures of the liver; Objective 26—List the functions of the liver; Objective 29—Label the major structures of the liver, pancreas, and gallbladder
(1) structure and location	
(2) functions	
c. gallbladder	Module Set II, Module 12: Objective 7—Label the major organs and structures of the digestive system; Objective 28—Complete statements that describe the characteristics and structures of the gallbladder; Objective 29—Label the major structures of the liver, pancreas, and gallbladder
(1) structure and location	
(2) functions	
d. pancreas	Module Set II, Module 12: Objective 7—Label the major organs and structures of the digestive system; Objective 27—Complete statements that describe the characteristics and structures of the pancreas; Objective 29—Label the major structures of the liver, pancreas, and gallbladder
(1) structure and location	
(2) functions	

6. Basic nutrients a. carbohydrates b. fats c. proteins d. mineral salts e. vitamins f. water	Module Set I, Module 2: Objective 9—Describe the primary role of each of the principal elements and compounds in the body; Objective 11—State the functions of the major types of organic compounds in the body; Module Set II, Module 12: Objective 2—State the functions of the digestive system
7. Terminology associated with digestion and elimination	
a. catabolism	Module Set I, Module 2: Objective 19—Define the term *metabolism*
b. anabolism	Module Set I, Module 2: Objective 19—Define the term *metabolism*
c. digestion	✔ **NOTE:** See the functions of the digestive system in Module Set II, Module 12: Objective 2.
d. absorption	✔ **NOTE:** See the functions of the digestive system in Module Set II, Module 12: Objective 2.
e. metabolism	Module Set I, Module 2: Objective 19—Define the term *metabolism* ✔ **NOTE:** See the functions of the digestive system in Module Set II, Module 12: Objective 2.
f. peristalsis	✔ **NOTE:** See the term *peristaltic motion* in Module Set II, Module 12: Objective 24.
g. defecation	Module Set II, Module 12: Objective 2—State the functions of the digestive system
h. regurgitation i. reflux	✔ **NOTE:** See the definition of the term *emesis* in Module Set II, Module 12: Objective 30.
j. ulcer	Module Set II, Module 12: Objective 30—Match common disorders and abnormalities of the alimentary tract to their correct definitions
k. jaundice	Module Set II, Module 12: Objective 30—Match common disorders and abnormalities of the alimentary tract to their correct definitions
l. diarrhea	Module Set II, Module 12: Objective 30—Match common disorders and abnormalities of the alimentary tract to their correct definitions

7. Terminology associated with digestion and elimination (cont.)	
m. constipation n. incontinence o. flatus p. other	Module Set II, Module 12: Objective 30—Match common disorders and abnormalities of the alimentary tract to their correct definitions
P. Urinary System	
1. Structures and functions	Module Set II, Module 13: Objective 1—Define the term *urinary system*; Objective 2—State the functions of the urinary system; Objective 3—Define the major organs and structures of the urinary system; Objective 4—Label the major organs and structures of the urinary system; Objective 16—Complete statements that describe the processes for producing and expelling urine
a. kidneys	Module Set II, Module 13: Objective 5—Complete statements that describe the characteristics and external structure of the kidneys; Objective 10—State functions of the kidneys
b. renal vessels	Module Set II, Module 13: Objective 6—Define the major internal macroscopic structures of a kidney; Objective 7—Label the major internal macroscopic structures of a kidney; Objective 8—Complete statements that describe the characteristics of the internal microscopic structures of a kidney ✔ **NOTE:** See also #2 below.
c. ureters	Module Set II, Module 13: Objective 11—Complete statements that describe the characteristics and structure of the ureters
d. bladder	Module Set II, Module 13: Objective 12--Complete statements that describe the characteristics and structure of the urinary bladder
e. urethra	Module Set II, Module 13: Objective 13—Complete statements that describe the characteristics and structure of the female urethra; Objective 14—Complete statements that describe the characteristics and structure of the male urethra
2. Nephron unit a. structure b. functions	Module Set II, Module 13: Objective 8—Complete statements that describe the characteristics of the internal microscopic structures of a kidney; Objective 9—Label the major microscopic structures of a nephron

3. Urine composition a. water b. nitrogenous/metabolic wastes c. mineral salts d. crystals e. pigment	Module Set II, Module 13: Objective 15—Complete statements that describe the normal physical characteristics of urine
4. Abnormal components of urine a. glucose b. albumin c. blood d. ketones/acetone e. plasma proteins f. bacterial/pus cells g. casts h. other	Module Set II, Module 13: Objective 17—List the common abnormal constituents of urine ✔ **NOTE:** See the discussion of calculi in Module Set II, Module 13: Objective 18.
Q. Reproductive System—Male and Female	
1. Structures of the female reproductive system a. external b. internal c. mammary glands	Module Set II, Module 15: Objective 5—List the major divisions of the female reproductive system
2. Functions of the female reproductive organs	Module Set II, Module 15: Objective 4—State the functions of the female reproductive system; Objective 6—Define the major organs and structures of the internal female reproductive system; Objective 7—Label the major internal organs and structures of the female reproductive system

2. Functions of the female reproductive organs (cont.)	
a. vulva	Module Set II, Module 15: Objective 12—Complete statements that describe the major structures of the external female reproductive system; Objective 14—Label the major structures of the external female reproductive system
b. vagina	Module Set II, Module 15: Objective 11—Complete statements that describe the characteristics and structure of the vagina; Objective 14—Label the major structures of the external female reproductive system
c. glands	Module Set II, Module 15: Objective 12—Complete statements that describe the major structures of the external female reproductive system
d. ovaries	Module Set II, Module 15: Objective 8—Complete statements that describe the characteristics and structure of the ovaries; Objective 13—Label the major structures and substructures of the internal female reproductive system
e. fallopian tubes	Module Set II, Module 15: Objective 9—Complete statements that describe the characteristics and structure of the fallopian tubes; Objective 13—Label the major structures and substructures of the internal female reproductive system
f. uterus	Module Set II, Module 15: Objective 10—Complete statements that describe the characteristics and structure of the uterus; Objective 13—Label the major structures and substructures of the internal female reproductive system
g. breasts	Module Set II, Module 15: Objective 15—Complete statements that describe the characteristics and structure of the breasts; Objective 16—Label the major structures of a female breast
3. Menstrual cycle a. proliferative phase b. ovulation c. progestational phase d. menstrual phase	Module Set II, Module 15: Objective 18—Complete statements that describe menstruation and the menstrual cycle

4. Terminology related to pregnancy	
a. fertilization	Module Set II, Module 15: Objective 3—Define the term *fertilization*
b. implantation	Module Set II, Module 15: Objective 10—Complete statements that describe the characteristics and structure of the uterus; Objective 22—Complete statements that describe the characteristics of fetal development
c. placenta	Module Set II, Module 15: Objective 21—Complete statements that describe the characteristics of pregnancy
d. amnion	Module Set II, Module 15: Objective 21—Complete statements that describe the characteristics of pregnancy
e. chorion	
f. embryo	Module Set II, Module 15: Objective 3—Define the term *fertilization*
g. fetus	Module Set II, Module 15: Objective 3—Define the term *fertilization*
h. gestation	Module Set II, Module 15: Objective 21—Complete statements that describe the characteristics of pregnancy
i. gravity	✔ **NOTE:** See the discussion of how gravity affects the position of the cervix in Module Set II, Module 15: Objective 10—Complete statements that describe the characteristics and structure of the uterus.
j. parity	
k. abortion	
l. miscarriage	
m. prematurity	Module Set II, Module 15: Objective 24—Define terms that describe types of abnormal deliveries
n. other	
5. Structures of the male reproductive system	Module Set II, Module 14: Objective 4—Define the major glands and structures of the male reproductive system; Objective 5—Label the major glands and structures of the male reproductive system
a. external	
b. internal	

6. Functions of the male reproductive organs	Module Set II, Module 14: Objective 1—Define the term *male reproductive system*; Objective 2—State the functions of the male reproductive system; Objective 4—Define the major glands and structures of the male reproductive system; Objective 5—Label the major glands and structures of the male reproductive system
a. penis	Module Set II, Module 14: Objective 13—Complete statements that describe the characteristics and structure of the penis
b. scrotum	Module Set II, Module 14: Objective 6—Complete statements that describe the characteristics and structure of the scrotum
c. urethra	Module Set II, Module 14: Objective 13—Complete statements that describe the characteristics and structure of the penis; Objective 14—Describe the stages of development of the male reproductive organs
d. testes	Module Set II, Module 14: Objective 7—Complete statements that describe the characteristics and structure of the testes
e. epididymis	Module Set II, Module 14: Objective 8—Complete statements that describe the characteristics and structure of the epididymis
f. vas deferens	Module Set II, Module 14: Objective 9—Complete statements that describe the characteristics and structure of the vas deferens
g. seminal vesicles	Module Set II, Module 14: Objective 10—Complete statements that describe the characteristics and structure of the seminal vesicles
h. ejaculatory ducts	Module Set II, Module 14: Objective 10—Complete statements that describe the characteristics and structure of the seminal vesicles; Objective 12—Complete statements that describe the characteristics and structure of the bulbourethral glands
i. prostate gland	Module Set II, Module 14: Objective 11—Complete statements that describe the characteristics and structure of the prostate gland
j. inguinal canal	Module Set II, Module 14: Objective 9—Complete statements that describe the characteristics and structure of the vas deferens

R. Endocrine System

1. Pituitary gland (hypophysis)	
a. location and structure	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 5—Complete statements that describe the structure and function of the pituitary gland
b. functions	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 5—Complete statements that describe the structure and function of the pituitary gland
c. action(s) of hormones produced	Module Set II, Module 5: Objective 6—Match the primary hormones of the pituitary gland to their correct functions
(1) thyroid-stimulating hormone (TSH)	
(2) follicle-stimulating hormone (FSH)	
(3) luteinizing hormone (LH)	
(4) growth hormone (GH)	
(5) adrenocorticotropic hormone (ACTH)	
(6) prolactin	
(7) oxytocin	
(8) antidiuretic hormone/vasopressin (ADH)	
2. Thyroid gland	
a. location and structure	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 8—Complete statements that describe the function of the thyroid gland
b. functions	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 8—Complete statements that describe the function of the thyroid gland

2. Thyroid gland (cont.)	
c. action(s) of hormones produced	Module Set II, Module 5: Objective 8—Complete statements that describe the function of the thyroid gland
(1) thyroxine	
(2) calcitonin	
3. Parathyroid glands	
a. location and structure	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 10—Complete statements that describe the function of the parathyroid glands
b. functions	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 10—Complete statements that describe the function of the parathyroid glands
c. action(s) of hormone produced	Module Set II, Module 5: Objective 10—Complete statements that describe the function of the parathyroid glands
(1) parathormone	
4. Adrenal/suprarenal glands	
a. location and structure	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 12—Complete statements that describe the structure and function of the adrenal glands
b. functions	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 12—Complete statements that describe the structure and function of the adrenal glands
c. action(s) of hormones produced	Module Set II, Module 5: Objective 13—Match the primary hormones of the adrenal glands to their correct functions
(1) glucocorticoids	
(2) mineralocorticoids	
(3) androgens	
(4) catecholamines	

5. Pancreas: islets of Langerhans	
a. location and structure	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 17—Complete statements that describe the function of the pancreas (islets of Langerhans)
b. functions	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 17—Complete statements that describe the function of the pancreas (islets of Langerhans)
c. action(s) of hormones produced	Module Set II, Module 5: Objective 17—Complete statements that describe the function of the pancreas (islets of Langerhans)
(1) insulin	
(2) glucagon	
6. Gonads	
a. location and structure	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 15—Complete statements that describe the function of the gonads
b. functions	Module Set II, Module 5: Objective 3—Match the major glands of the endocrine system to their correct definitions; Objective 4—Label the major glands of the endocrine system; Objective 15—Complete statements that describe the function of the gonads
c. action(s) of hormones produced	Module Set II, Module 5: Objective 15—Complete statements that describe the function of the gonads
(1) testosterone	
(2) estrogens	
(3) progesterone	

AST Course Outline	MAVCC Module Objectives
IV. MICROBIOLOGY AND WOUND HEALING	
A. Introduction to Microbiology	
1. Historical background a. Hippocrates b. Vesalius c. Galen d. Semmelweis e. Holmes f. van Leeuwenhoek g. Pasteur h. Lister i. Koch j. Fleming k. Salk	✔ **NOTE:** See the teacher's edition for Module Set I, Module 2: Optional Assignment Sheet 1—Complete an overview of an important figure, field of study, or theory of biochemistry and microbiology.
2. Fields of study a. basic b. medical c. agricultural d. sanitary e. industrial	✔ **NOTE:** See the teacher's edition for Module Set I, Module 2: Optional Assignment Sheet 1—Complete an overview of an important figure, field of study, or theory of biochemistry and microbiology.
3. Historical theories a. identification of bacteria b. abiogenesis c. biogenesis d. germ theory of fermentation e. germ theory of disease f. Koch's postulates g. techniques of sterilization and disinfection	✔ **NOTE:** See the teacher's edition for Module Set I, Module 2: Optional Assignment Sheet 1—Complete an overview of an important figure, field of study, or theory of biochemistry and microbiology.

4. Microscope a. parts of a microscope b. use of a microscope (in a lab setting) c. agar and Rodac plates	
5. Terminology a. microbiology b. bacteriology c. protozoology d. parasitology e. helminthology f. virology	Module Set I, Module 2: Objective 1—Define the terms *biochemistry* and *microbiology*
B. Cell Structure	
1. Cells a. cell theory	Module Set I, Module 2: Objective 23—State the cell theory
b. basic characteristics	✔ **NOTE:** The basic characteristics of cells are discussed in Module Set I, Module 2: Objective 24 through Objective 40.
2. Cell structure a. cell membrane	Module Set I, Module 2: Objective 26—Label the major parts of a cell; Objective 27—Match the major parts of a cell to their correct functions
b. nucleus vs. nucleoid	Module Set I, Module 2: Objective 26—Label the major parts of a cell; Objective 27—Match the major parts of a cell to their correct functions
c. cytoplasm	Module Set I, Module 2: Objective 26—Label the major parts of a cell; Objective 27—Match the major parts of a cell to their correct functions
d. cytoplasmic particles	Module Set I, Module 2: Objective 26—Label the major parts of a cell; Objective 27—Match the major parts of a cell to their correct functions
e. cell wall	Module Set I, Module 2: Objective 26—Label the major parts of a cell; Objective 27—Match the major parts of a cell to their correct functions

2. Cell structure (cont.)	
f. flagella	Module Set I, Module 2: Objective 29—Describe the specialized structures in cells; Objective 30—State the functions of the specialized structures in cells
g. pili or fimbriae	✔ **NOTE:** The term *fimbriae tubae* is discussed in Module Set II, Module 15, which deals with the female reproductive system.
h. capsules	Module Set I, Module 2: Objective 43—Describe the classes of microorganisms
i. spores	Module Set I, Module 2: Objective 43—Describe the classes of microorganisms
3. Classification of organisms a. kingdom b. phylum c. class d. order e. family f. genus g. species	Module Set I, Module 2: Objective 41—Arrange in order the levels in the taxonomy system used to classify organisms
4. Specific classes of microorganisms a. algae b. protozoa c. fungi (yeasts and molds) d. bacteria e. rickettsiae f. viruses	Module Set I, Module 2: Objective 43—Describe the classes of microorganisms; Objective 44—Label the classes of microorganisms as classified by their shape; Objective 46—Describe the purpose of a gram stain
5. Characteristics of algae a. morphology b. occurrence c. relationship to humans d. uses	Module Set I, Module 2: Objective 51—Complete statements that describe the characteristics of fungi and algae

6. Characteristics of protozoa a. morphology b. nutrition c. classification according to locomotion d. pathogenicity e. occurrence in humans f. occurrence in nature	Module Set I, Module 2: Objective 50—Complete statements that describe the characteristics of protozoa
7. Characteristics of fungi (yeasts and molds) a. morphology b. nutrition c. reproduction methods d. pathogenicity e. occurrence in humans f. occurrence in nature	Module Set I, Module 2: Objective 51—Complete statements that describe the characteristics of fungi and algae
8. Characteristics of bacteria a. morphology and grouping b. staining c. motility d. colonization e. nutrition f. biochemical activities g. pathogenicity h. occurrence in humans i. occurrence in nature	Module Set I, Module 2: Objective 47—Complete statements that describe the characteristics of bacteria
9. Characteristics of rickettsiae a. morphology b. staining	Module Set I, Module 2: Objective 48—Complete statements that describe the characteristics of rickettsiae

9. Characteristics of rickettsiae (cont.) c. transmission d. pathogenicity e. occurrence in humans f. occurrence in nature	Module Set I, Module 2: Objective 48—Complete statements that describe the characteristics of rickettsiae
10. Characteristics of viruses a. classification b. morphology c. differentiation from other cells d. lysogenic cycle e. bacteriophages f. genetic changes g. transmission h. pathogenicity i. occurrence in humans j. occurence in nature	Module Set I, Module 2: Objective 49—Complete statements that describe the characteristics of viruses
C. Functions of Microorganisms	
1. Nutrition a. nutritional requirements b. nutritional types c. metabolism	Module Set I, Module 2: Objective 19—Define the term *metabolism*; Objective 20—Complete statements that describe the use of energy by the body; Objective 22—State definitions of the basic activities that define life
2. Microbial growth a. factors that influence growth b. methods of bacterial count c. growth curve	
3. Microbial genetics a. chromosomes and genes	Module Set I, Module 2: Objective 37—Describe the types of cell reproduction

3. Microbial genetics (cont.)	
b. mutations	Module Set I, Module 2: Objective 38—Describe the process in which the genetic makeup of a cell can be changed; Objective 39—List the sources of mutation-causing conditions
c. phage conversions	
d. transduction	
e. transformation	
f. conjugation	
4. Terminology	
a. autotroph	
b. heterotroph	
c. chemotroph	
d. phototroph	
e. catabolism	Module Set I, Module 2: Objective 19—Define the term *metabolism*
f. anabolism	Module Set I, Module 2: Objective 19—Define the term *metabolism*
g. photosynthesis	
h. other	
D. Humans and Microorganisms	
1. Organisms in the environment	
a. occurrence	
b. cycling of nutrients	
c. environmental factors	
2. Normal human flora	Module Set I, Module 2: Objective 45—Define the terms *resident flora* and *transient flora*; Module Set I, Module 3: Objective 6—Complete statements that describe the role of the body's portals of entry and portals of exit in the spread of infectious diseases; Objective 8—List the factors that determine whether a pathogen will cause a disease in a host's body
a. skin	
b. mouth	
c. respiratory tract	
d. ear and eye	
e. gastrointestinal tract	
f. urogenital area	

3. Relationships of organisms to each other	Module Set I, Module 2: Objective 42—Match the types of relationships between organisms to their correct descriptions
a. symbiosis	
b. mutualism	
c. commensalism	
d. neutralism	
e. parasitism	
f. pathogenic	
g. nonpathogenic	
4. Terminology	
a. antibiosis	
b. infestation	Module Set I, Module 2: Objective 43—Describe the classes of microorganisms
c. infection	Module Set I, Module 3: Objective 1—Define the term *infection*; Objective 4—Match types of infections and diseases to their correct descriptions
d. opportunism	Module Set I, Module 2: Objective 45—Define the terms *resident flora* and *transient flora*
e. synergism	
f. other	
E. Process of Infection	
1. Factors affecting establishment of infection	Module Set I, Module 3: Objective 8—List the factors that determine whether a pathogen will cause a disease in a host's body
a. location	
b. antibacterial factors	
c. normal flora	
d. bacteriocidins	
e. antibodies	
f. phagocytes	
2. Development of infection	
a. invasion of host	Module Set I, Module 3: Objective 2—Complete statements that describe the effects of infection on a human host; Objective 8—List the factors that determine whether a pathogen will cause a disease in a host's body

2. Development of infection (cont.) b. host reaction-inflammation	Module Set I, Module 3: Objective 14—Define the types of cellular and tissue defense-mechanism processes the body uses against disease and infection
3. Types of disease processes a. local infection b. systemic infection c. acute infection d. chronic infection e. latent infection f. primary disease g. secondary disease	Module Set I, Module 3: Objective 4—Match types of infections and diseases to their correct descriptions
4. Course of disease a. incubation b. illness c. convalescence or death	Module Set I, Module 3: Objective 5—Define the phases in the course of a disease
5. Virulence of pathogens a. ability to infect b. invasiveness c. toxigenicity	Module Set I, Module 3: Objective 9—Define the factors that influence the virulence of a pathogen in a host's body
6. Reservoirs of infection a. living hosts b. inanimate objects or materials	Module Set I, Module 3: Objective 7—List sources of the microorganisms that cause infectious diseases
7. Transmission of infection a. skin contact b. mucus c. air-dust d. food-water-soil e. blood f. fomites g. arthropods h. healthy human carriers	Module Set I, Module 3: Objective 6—Complete statements that describe the role of the body's portals of entry and portals of exit in the spread of infectious diseases; Objective 7—List sources of the microorganisms that cause infectious diseases

8. Factors involved in nosocomial infections a. improper hand-washing technique b. inappropriate use of antibiotics c. false sense of security d. types of surgery e. patient overcrowding/understaffing f. staffing: education and background of workers g. immunosuppressive agents h. other	Module Set I, Module 3: Objective 32—List factors that contribute to the spread of nosocomial infections
9. Causative agents a. *Staphylococcus aureus* b. *Streptococcus* species c. *Escherichia coli* d. *Pseudomonas aeruginosa* e. *Mycobacterium* species f. human immunodeficiency virus (HIV) g. hepatitis B virus (HBV) h. human papilloma virus (HPV) i. other	Module Set I, Module 3: Objective 33—Match organisms that cause common nosocomial infections to the infections they cause
10. Types of isolation a. total b. protective (reverse) c. enteric d. wound and skin e. respiratory f. blood/body fluids	Module Set I, Module 3: Objective 34—Describe types of patient isolation used in health-care facilities

11. Universal precautions: CDC guidelines a. hand-washing b. handling of body fluids/specimens (1) goggles (2) masks (3) gloves (4) impermeable clothing/ coverups c. handling of sharps (1) disposable containers (2) no recapping needles (3) "no touch" passing (4) staples instead of sutures where possible d. disposal of medical waste (1) garbage (2) fluids e. terminal sterilization of reusables	Module Set I, Module 3: Objective 35—Complete statements that describe recommended precautions and guidelines used in surgical suites to reduce the spread of infection
F. General Defense Mechanisms	
1. Skin and mucous membranes: first line of defense a. perspiration acidity and salinity b. other secretions (1) tears (2) saliva (3) vaginal secretions (4) mucus (5) cerumen c. normal microbial flora	Module Set I, Module 3: Objective 10—State the functions of the body's physical barriers to infection
2. Body systems' defense mechanisms a. ciliated membranes b. lysozymes c. digestive fluids	Module Set I, Module 3: Objective 11—State the functions of special structures, chemicals, and actions within the body that provide protection against infection

2. Body systems' defense mechanisms (cont.) d. normal flora e. flushing action f. protective reflexes	Module Set I, Module 3: Objective 11—State the functions of special structures, chemicals, and actions within the body that provide protection against infection
3. Cellular and tissue defense mechanisms	
a. phagocytosis	Module Set I, Module 3: Objective 14—Define the types of cellular and tissue defense-mechanism processes the body uses against disease and infection; Objective 15—Match types of white blood cells to their correct descriptions; Objective 17—Describe the stages of phagocytosis
b. serum proteins	Module Set I, Module 3: Objective 14—Define the types of cellular and tissue defense-mechanism processes the body uses against disease and infection; Objective 18—Distinguish between the definitions of a T cell and a B cell; Objective 19—Match types of T cells and B cells to their correct functions; Objective 20—Distinguish between descriptions of the types of immunity development in the serum-protein response; Objective 21—Describe the stages of cell-mediated immunity development in the serum-protein response; Objective 22—Describe the stages of humoral-mediated immunity development in the serum-protein response
c. interferon	Module Set I, Module 3: Objective 14—Define the types of cellular and tissue defense-mechanism processes the body uses against disease and infection; Objective 16—Describe the stages of the interferon response
d. inflammatory reaction	Module Set I, Module 3: Objective 14—Define the types of cellular and tissue defense-mechanism processes the body uses against disease and infection; Objective 24—Describe the stages of the inflammatory reaction
G. Immunologic Defense Mechanisms	
1. Immunology a. antigen b. antibody/immunoglobulin c. antigen-antibody reaction	Module Set I, Module 3: Objective 12—Define the term *immunology*; Objective 23—Define the phases of the antibody-production cycle that follows the body's exposure to an antigen

2. Immune response a. lag phase b. primary response c. secondary response	Module Set I, Module 3: Objective 23—Define the phases of the antibody-production cycle that follows the body's exposure to an antigen
3. Acquired immunity a. active b. passive	Module Set I, Module 3: Objective 13—Define the types of immunity
4. Active acquired immunity a. natural b. artificial	Module Set I, Module 3: Objective 13—Define the types of immunity
5. Passive acquired immunity a. natural b. artificial	Module Set I, Module 3: Objective 13—Define the types of immunity
6. Sources of vaccines a. nonpathogenic strains b. closely related microorganisms c. attenuated living pathogens d. killed pathogens e. extracts of pathogens f. toxoids	Module Set I, Module 3: Objective 25—Match types of vaccines to their correct definitions
7. Hypersensitivity a. immediate b. delayed c. autoimmunity	Module Set I, Module 3: Objective 26—Define the term *hypersensitive response*; Objective 27—Define the types of hypersensitive responses
8. Terminology a. allergen b. allergy c. localized allergic reaction d. anaphylactic shock e. in vitro tests	Module Set I, Module 3: Objective 26—Define the term *hypersensitive response* Module Set I, Module 2: Objective 43—Describe the classes of microorganisms Module Set I, Module 3: Objective 26—Define the term *hypersensitive response*

8. Terminology (cont.) f. in vivo tests g. other	
H. Principles of Sanitation, Sterilization, and Disinfection	
1. Reasons for controlling microbial growth a. infectious diseases b. preservation of food c. industry d. research	Module Set I, Module 3: Objective 29—State reasons certain industries must control the growth of microorganisms
2. Necessary factors for infection a. organism in sufficient numbers b. sufficient virulence of organism c. portal of entry d. susceptible host	Module Set I, Module 3: Objective 8—List the factors that determine whether a pathogen will cause a disease in a host's body
3. Factors influencing microbial growth a. source of nutrition b. temperature c. moisture d. osmotic pressure e. pH f. barometric pressure g. oxygen requirements	
4. Effectiveness of antimicrobial procedures a. time b. temperature c. concentration d. type of microbes e. number of microbes f. microbial defenses	Module Set I, Module 3: Objective 30—Describe the factors that determine the effectiveness of an antimicrobial procedure

5. Physical antimicrobial methods a. moist heat b. dry heat c. pressurized steam d. cold e. drying f. radiation g. ultrasonic waves h. filtration	Module Set I, Module 3: Objective 31—Match types of antimicrobial-control methods to their correct descriptions
6. Chemical antimicrobial method a. antiseptics b. disinfectants c. sterilants d. other	Module Set I, Module 3: Objective 31—Match types of antimicrobial-control methods to their correct descriptions
7. Action of chemicals a. injure cell membranes b. inactivate enzymes c. damage genetic material d. interfere with metabolism	Module Set I, Module 3: Objective 31—Match types of antimicrobial-control methods to their correct descriptions
8. Terminology a. antiseptic	Module Set I, Module 3: Objective 3—Complete statements that describe methods used to reduce the spread of infection; Objective 28—Match methods used to control the spread of microorganisms to their correct definitions
b. aseptic	Module Set I, Module 3: Objective 23—Define the phases of the antibody-production cycle that follows the body's exposure to an antigen
c. bactericidal	✔ **NOTE:** See the definition of the term *bacteriocidin* in Module Set I, Module 3: Objective 8—List the factors that determine whether a pathogen will cause a disease in a host's body.
d. bacteriostatic	

8. Terminology (cont.)	
e. chemical sterilization	Module Set I, Module 3: Objective 31—Match types of antimicrobial-control methods to their correct descriptions
f. disinfectant	Module Set I, Module 3: Objective 28—Match methods used to control the spread of microorganisms to their correct definitions
g. disinfection	Module Set I, Module 3: Objective 31—Match types of antimicrobial-control methods to their correct descriptions
h. germicide	
i. sanitation	
j. sporicidal	
k. sterilization	Module Set I, Module 3: Objective 3—Complete statements that describe methods used to reduce the spread of infection; Objective 28—Match methods used to control the spread of microorganisms to their correct definitions
l. thermal death point	
m. thermal death time	
n. chemical death point	
o. chemical death time	
I. Wound Healing	
1. Causes of damage to tissue	Module Set I, Module 4: Objective 23—Define the types of injuries that can damage tissue
a. surgical incision	
b. traumatic wounds	
c. chemicals	
d. heat/cold	
e. bacteria	
f. burns	
g. other	
2. Traumatic wounds	Module Set I, Module 4: Objective 24—Match the types of traumatic wounds to their correct definitions
a. abrasion	
b. incised wound	
c. lacerated wound	
d. puncture wound	

3. Inflammatory process a. redness b. heat c. swelling d. pain	Module Set I, Module 3: Objective 14—Define the types of cellular and tissue defense-mechanism processes the body uses against disease and infection; Objective 24—Describe the stages of the inflammatory reaction; Module Set I, Module 4: Objective 25—Describe the causes of the characteristics of the inflammation response
4. Healing process a. fibrinogen b. fibroblasts c. collagen d. network of fibers e. scar tissue	Module Set I, Module 4: Objective 26—Complete statements that describe the phases in the body's healing response
5. Types of healing a. first intention b. second intention c. third intention	Module Set I, Module 4: Objective 27—Distinguish among statements that describe the types of treatment responses in the treatment of wounds
6. Stages/phases of wound healing a. lag phase b. proliferation phase c. maturation	Module Set I, Module 4: Objective 26—Complete statements that describe the phases in the body's healing response
7. Factors influencing healing a. age b. nutritional status c. physical condition d. surgical technique e. infection f. other	Module Set I, Module 4: Objective 28—Describe the factors that affect the wound-healing process
8. Complications a. hemorrhage b. sinus tract formation c. hematoma d. infection e. herniation	Module Set I, Module 4: Objective 29—Define factors that present possible complications to the wound-healing process

8. Complications (cont.) f. wound disruption g. other	Module Set I, Module 4: Objective 29—Define factors that present possible complications to the wound-healing process
9. Classification of surgical wounds a. clean (class I) b. clean/contaminated (class II) c. contaminated (class III) d. infected (class IV)	Module Set I, Module 4: Objective 30—Match the classifications of surgical wounds to their correct descriptions
10. Terminology	
a. adhesions	
b. collagen	Module Set I, Module 4: Objective 26—Complete statements that describe the phases in the body's healing response
c. contamination	
d. debridement	
e. dehiscence	Module Set I, Module 4: Objective 29—Define factors that present possible complications to the wound-healing process
f. evisceration	Module Set I, Module 4: Objective 29—Define factors that present possible complications to the wound-healing process
g. fibrinogen	Module Set I, Module 4: Objective 26—Complete statements that describe the phases in the body's healing response
h. fibroblasts	Module Set I, Module 3: Objective 16—Describe the stages of the interferon response; Module Set I, Module 4: Objective 26—Complete statements that describe the phases in the body's healing response
i. gangrene	
j. granulation	Module Set I, Module 4: Objective 27—Distinguish among statements that describe the types of treatment responses in the treatment of wounds
k. hematoma	Module Set I, Module 4: Objective 29—Define factors that present possible complications to the wound-healing process
l. hemorrhage	Module Set I, Module 4: Objective 29—Define factors that present possible complications to the wound-healing process

10. Terminology (cont.)	
m. hemostasis	✔ **NOTE:** The blood-clotting process (blood coagulation) is discussed in Objective 17 in Module Set II, Module 7, which deals with blood and the circulatory system.
n. herniation	Module Set I, Module 4: Objective 29—Define factors that present possible complications to the wound-healing process
o. keloid	
p. "proud flesh"	✔ **NOTE:** See the description of scar tissue in the maturation phase of the body's healing process in Module Set I, Module 4: Objective 26.
q. serosanguinous	
r. trauma	Module Set I, Module 4: Objective 23—Define the types of injuries that can damage tissue
s. other	

MODULE SET II:
Major Body Systems

Module 1: Integumentary System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Integumentary System	9
2—Major Structures of the Integument	11
3—Major Structures of the Integument (cont.)	13
Written Test	15
Answers to Written Test	21
Answers to Assignment Sheets	25
Crossword Puzzles	
1—Terms from Objectives 1 Through 5	27
2—Terms from Objective 6	29
3—Terms from Objectives 7 Through 10	31
4—Terms from Objectives 11 Through 14	33
Answers to Crossword Puzzles	35
Module Review	37
Answers to Module Review	49

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 6 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 7 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining sections in the student edition: assignment sheets.
- Have students complete the assignment sheets.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This is the first module to deal with a specific body system. Use this module to introduce the fact that most of the remaining modules will focus on specific systems. Give the students an overview of this and the remaining modules.

- Use crossword puzzles 1 through 4 to help reinforce the terms in the associated objectives.
- To introduce this module, consider that many of your students may not have thought of the skin as an organ. Remind students that an organ is a structure consisting of more than one type of tissue and having a specific function. This definition will help to introduce the first five objectives, which define the integument, explain its functions, and describe its tissue structure. Encourage the students to consider the skin in terms of its functions relative to other organs and their functions. At this point, the students have not formally studied other organs, but they will be somewhat familiar with some of the more obvious, such as the heart. This approach may help the students realize that body systems are more complex than they have yet considered.
- Use the following points to supplement your discussion of Objective 3, which describes the characteristics of the skin.
  - Discuss skin hygiene and how it influences health and the spread of disease. If not already done, demonstrate proper hand-washing techniques or remind students of these techniques. Emphasize your facility's requirements for hand washing for various situations, such as after going to the restroom, before handling sterile equipment, after working with patients with various conditions, etc.
  - When discussing the fourth point in Objective 3, tell students that the skin is not just external; it provides coverage into the mouth, nose, ears, and other orifices connecting to mucous membranes.
  - When discussing the fifth point in Objective 3, talk about blushing, the inflammatory response, and other factors that affect the flow of blood to the surface of the skin. Have each student squeeze the base of the little finger on one hand between the thumb and index finger of the other hand for 10 to 15 seconds and then release it. They should observe that the end of the finger is flush, and when they remove the compression, the compressed area should appear pale but then quickly return to normal color. Explain the role of blood in the skin's coloration. Also, discuss melanin and its effect on complexion. Have the students compare skin tones, freckling, etc., being careful not to allow judgmental assessments of skin color or pigmentation or blemishes.

- The major point of Objective 4, which lists the functions of the skin, is that the skin is a barrier to the outside world, but the barrier is selective. The skin allows certain substances to escape from the body to support waste elimination, body-temperature regulation, and other functions. However, the skin is also permeable to some chemicals that can be absorbed through the skin. Discuss the negative and positive aspects of this fact. For example, toxic chemicals, such as gasoline, may be poisonous by absorption through the skin, while some medications, such as nicotine patches, may provide treatment through the skin. Point out that breaks in the skin allow the entry of chemicals and microorganisms into the body that would not be able to penetrate intact skin. Discuss the care of surgical sites and burns in terms of a disruption of the skin barrier.

- To supplement your discussion of Objective 5—the major structures of the skin—use models and illustrations to discuss the structure of the skin, including the dermis and epidermis. Refer back to Module 4 in Module Set I, "Tissues, Membranes, and Wound Healing," to provide information and illustrations of squamous epithelial tissue and fibrous connective tissue. Use slides if available to view skin tissues. Illustrate the sensitivity of skin by having students try to touch the epidermis lightly enough to prevent sensation in the dermis. Discuss factors that would lead to variations in the thickness and numbers of layers of skin. Provide illustrations of the hypodermis and discuss its structure and function. A medical specialist can demonstrate relevant concepts, such as body composition (percent of body fat).

- Use the following strategies when discussing Objective 6, which concerns the layers of the epidermis, and Objective 7, which concerns the layers of the dermis.

  — Some students may be able to flake off cells from the stratum corneum to illustrate that it is essentially dead cells. To help students understand the concept of layers within layers (such as stratum spinosum), have the students view a hard-bound book on end. Point out that the front cover, the pages, and the back cover can each be considered as a separate layer. At the same time, each page can be thought of as a layer within the "page layer."

  — It may be difficult for students to envision the ability of the papillary layer of the dermis to create the ridges of the fingerprints. Again, using a book for illustration, show a soft-cover book on end. Push a section of pages and a cover toward the middle of the book to show that a bulge in the pages layer causes a similar ridge in the outer cover layer. Continue the illustration by saying that similar effects are caused by the connection of muscles to the reticular layer of the dermis, which can be easily illustrated by wrinkling the forehead. Provide samples of leather as an illustration of the toughness of the dermis. Discuss the importance of collagen in skin growth and healing.

- In association with Objective 8 through Objective 10, which define the term *auxiliary appendage* and discuss the hair and nails, allow students to study their skin under magnification and to look at one of their own hairs under a microscope. Then, ask the students to discuss the role of hair in humans. There is some value in cilia to move substances, in the eyelashes in protecting the eyes, and in head and facial hair for the protection of the cranium and preservation of heat in the head and on the face. Use this opportunity to discuss the role of the integumentary system in our appearance—hair styling, make-up, tanning, nail polish, etc. Discuss requirements of your facility in the care of hair and nails.

- For Objective 11, which states the functions of the glands located in the skin, discuss glands in a general way, reminding the students about earlier objectives related to the endocrine system. Point out that the glands in the skin are ducted glands. Discuss the importance of the glands in the integumentary system, their distribution over the body, and care of pores.

- Make the following points when discussing the types of nerve endings presented in Objective 12. At first, the difference in nerve sensations may not be apparent, so some demonstrations may be required to aid in students' understanding the distinctions. The sense of touch seems fairly obvious but probably is not fully understood by most students. Provide samples of a number of textures and substances—a cup of water, sandpaper, wood, metal, glass, cloth, etc. Allow the students to feel the differences in the "feel" (touch) of these objects. Next, ask each student to place a thumb against the forearm of the opposite arm. Ask them to steadily increase the pressure of the thumb against the arm and be aware of the sensation. Demonstrate the sensation of temperatures using a warm (not hot) and cool (not cold) object. Using a candle and ice, demonstrate that they can sense temperatures from a distance and recognize relative differences in heat and cold. Use the discussion of pain to provide the students with a brief overview of the nervous system in terms of signals being sent by the skin receptors to the brain.

- Use the drawings in Objective 13 to help identify all the structures of the integument you have defined and discussed in the previous objectives in the Information Sheet.

- Invite a dermatologist, plastic surgeon, or other specialist in a related field to discuss the last objective—the common disorders and abnormalities of the integument. Provide illustrations and discuss surgical interventions where appropriate. Discuss the role of the integumentary system in personal appearance and discuss the importance of self-image to patients and their concern about disfiguration, scarring, skin conditions that they may consider to be unsightly and how these feelings may make a patient reluctant to undergo a procedure or may interfere with their morale, thus possibly affecting the healing process. Discuss steps taken in surgical techniques to reduce scarring.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.

- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.

- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.

- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.

- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.

- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.

- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.

- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites offer general information about the integumentary system. Later modules list sites specific to the systems and disorders presented in that module.

- http://tray.dermatology.uiowa.edu/home.html

  This site offers many images of the skin and underlying tissues.

- http://www.science.ubc.ca/~biomania/tutorial/skin/skin01a.htm

  This tutorial covers much of the same material presented in the module in the student edition and provides a convenient interactive study that students can do on their own.

- http://arethusa.unh.edu/ANSC511/Lect21/sld001.htm

  This 28-slide program presents an outline of key points about the integumentary system, including slides that parallel the material in this module.

- http://www.kcmetro.cc.mo.us/maplewoods/Biology/Bio110/lab3.htm

  This site provides photos of prepared slides of various parts of the skin and auxiliary appendages at the cellular level.

- http://www.udel.edu/Biology/Wags/histopage/colorpage/colorpage.htm

  Similar to the previous entry, this site consists primarily of histology slides.

- http://cancernet.nci.nih.gov/location.html#skin

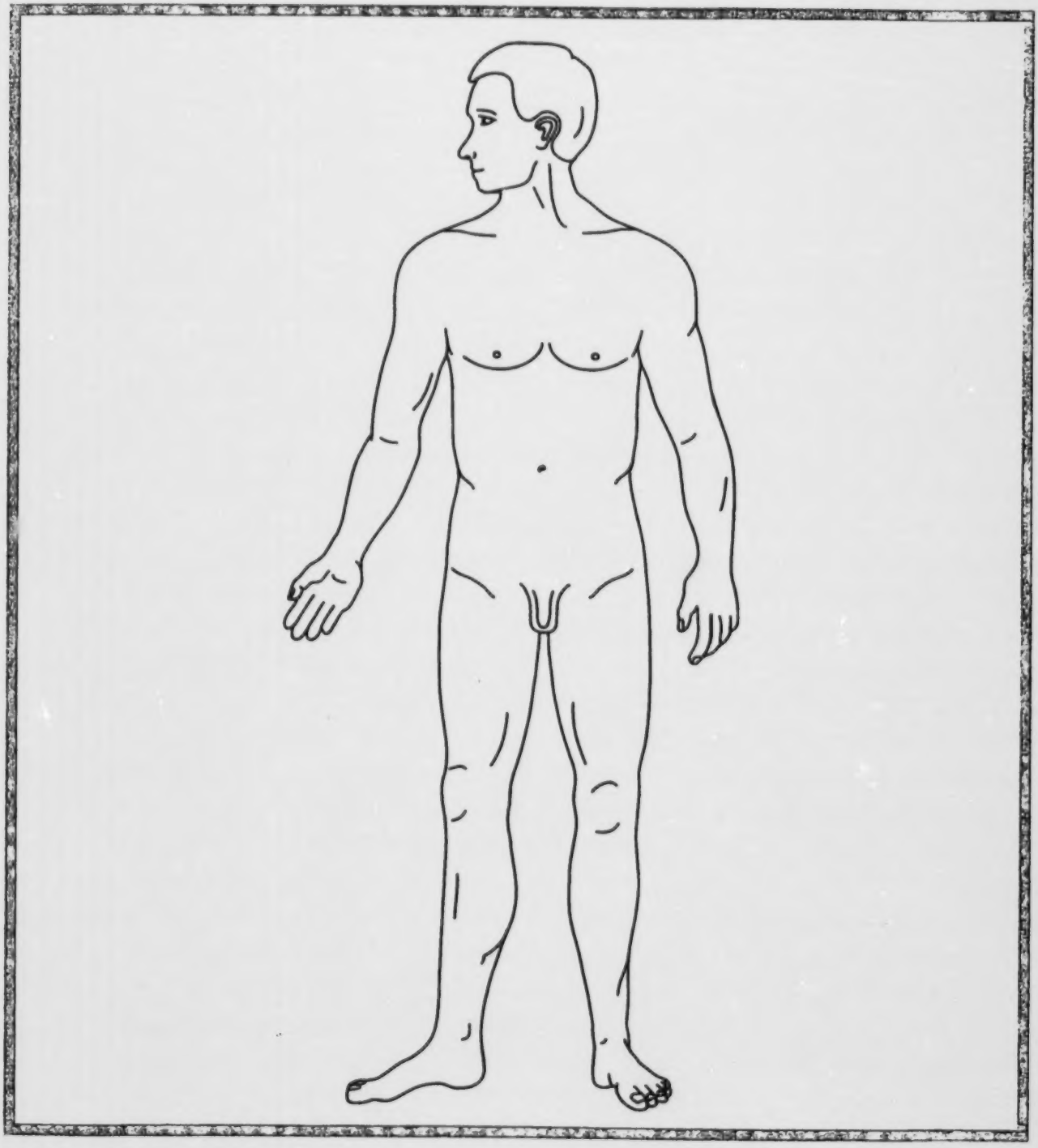
  The page cited is the National Institute of Health link to skin cancers. From this site, students can launch to pages dealing with various types of skin cancer and information about the appearance, cause, treatment, and other aspects of skin cancer.

- http://faculty.niagara.edu/bcliff/hapcstop.html

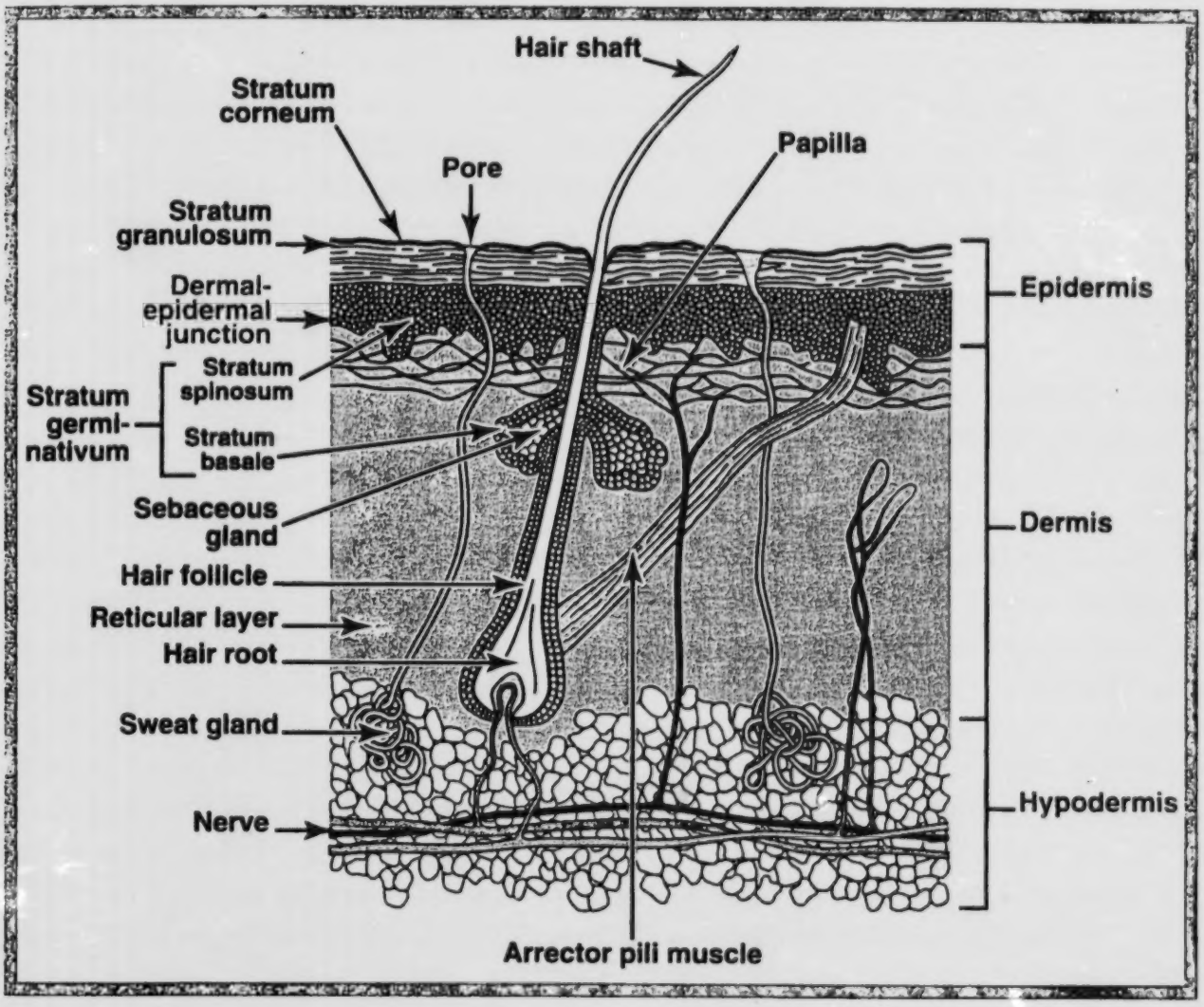
  The site listed contains case studies for a number of AST subject areas. The case studies are free to use as long as their source is acknowledged. The site includes a case study involving sunburn that can be given as a separate exercise or as part of Assignment Sheet 2.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

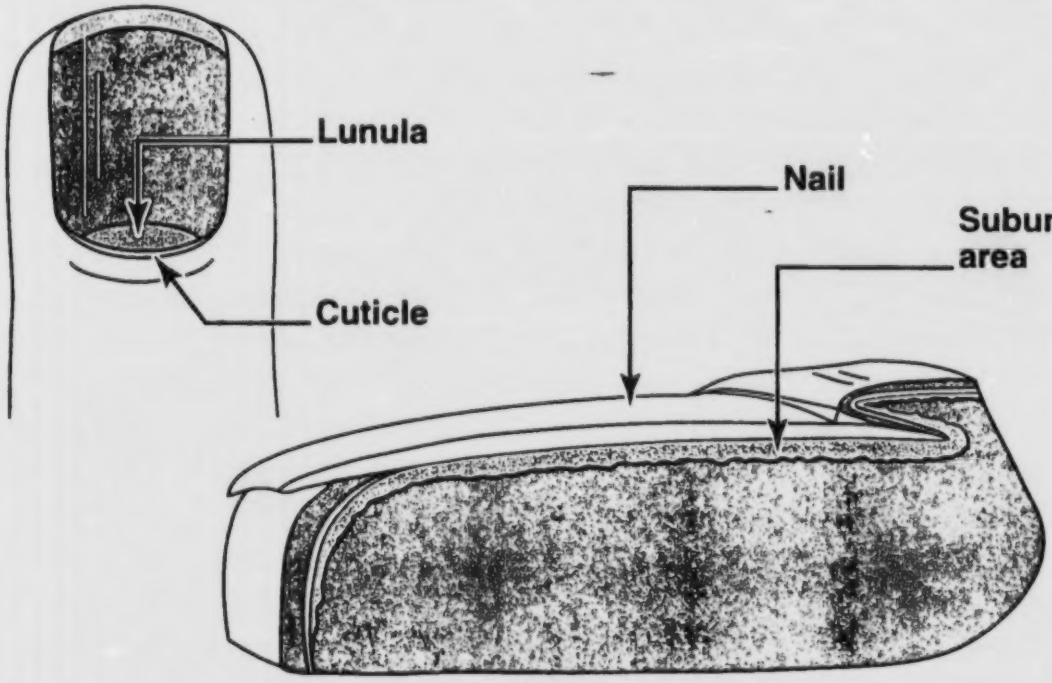
Integumentary System



Major Structures of the Integument



Major Structures of the Integument (cont.)



Major structures of a nail

Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *integument*. Write your answer on the blank lines provided beside the term below.

Integument _____

_____

Objective 2 List the major structures that make up the integument. Write your answers on the blank lines provided below.

a. _____

b. _____

Objective 3 Complete statements that describe the characteristics of the skin. Write your answers on the blank lines provided in the statements below.

a. The skin is the largest _____ of the body.

b. Skin varies in _____ over the body.

c. If skin is kept clean, it is the body's first line of defense against _____.

d. The skin connects to _____ membranes where it joins body cavities.

e. Skin color is the result of _____ and the amount of _____ near the surface of the skin.

Objective 4 List the functions of the skin. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

Objective 5

Describe the major structures of the skin. Write your answers on the blank lines provided beside each of the terms below.

a. Epidermis _____

_____

_____

_____

b. Dermis _____

_____

_____

_____

c. Dermal-epidermal junction _____

_____

_____

_____

d. Hypodermis _____

_____

_____

_____

Objective 6

Match the layers of the epidermis to their correct descriptions. Write the numbers on the blanks provided.

1. Stratum corneum
2. Stratum germinativum
3. Stratum granulosum
4. Stratum lucidum
5. Stratum spinosum

_____ a. The water-repellent, transparent inner layer of the epidermis found only on the palms of the hands and the soles of the feet

_____ b. The outermost layer of the epidermis where dead cells have been converted into keratin that continually flakes off

_____ c. The innermost layer of the epidermis where columnar cells continually undergo mitosis to make new cells and push older cells outward

_____ d. The keratin-synthesizing inner layer of the epidermis characterized by pronounced desmosomes that give the appearance of spikes running between the cells

_____ e. The inner layer of the epidermis with dying cells that develop granules of keratohyalin in their cytoplasm

Objective 7 Distinguish between descriptions of the layers of the dermis. Write an "R" on the blank line provided before the description of the reticular layer.

_____ a. The inner layer of the dermis that forms a network of interlacing cells and fibers, making this layer tough and elastic

_____ b. The outer layer of the dermis that lies next to the basal layer of the epidermis and is patterned with papillae and hollows

Objective 8 Define the term *auxiliary appendage*. Write your answer on the blank lines provided beside the term below.

Auxiliary appendage _____

_____

Objective 9 Complete statements that describe the characteristics of hair. Write your answers on the blank lines provided in the statements below.

a. Hair grows from a follicle in the skin; at the base of the follicle is a bundle of stratum _____ cells known as the *germinal matrix*; a dermal _____ joins the germinal matrix with _____ that support the mitosis of the germinal-matrix cells.

b. _____ muscles are attached to the follicles.

c. A hair consists of a part that protrudes from the skin—called the _____—and a subdermal section—called the _____.

d. Hair color results from _____ within the shaft.

e. Hair is kept soft by _____ that is secreted by two or more sebaceous glands.

f. Hair is found on all outer parts of the body except the _____ and the _____ areas of the hands and feet.

g. Hair on humans has little practical function except for the eyelashes, nasal hairs, and hair on the ears, all of which provide some level of protection against _____ and _____ matter.

h. Hair grows approximately _____ inch per month.

Objective 10

Complete statements that describe the characteristics of nails. Write your answers on the blank lines provided in the statements below.

a. Nails consist of epidermal cells that have been converted to _____.

b. Nails grow from epithelial cells lying under the _____ at the proximal end of a nail.

c. The region under a nail is called the _____ *area* (*nail bed*).

d. The skin surrounding a nail is called the _____.

Objective 11

State the functions of the glands located in the skin. Write your answers on the blank lines provided beside each of the terms below.

a. Sebaceous glands _____

_____

_____

_____

b. Sweat glands _____

_____

_____

_____

c. Ceruminous glands _____

_____

_____

_____

Objective 12

List the types of nerve endings found in the skin. Write your answers on the blank lines provided below.

a. _____

b. _____

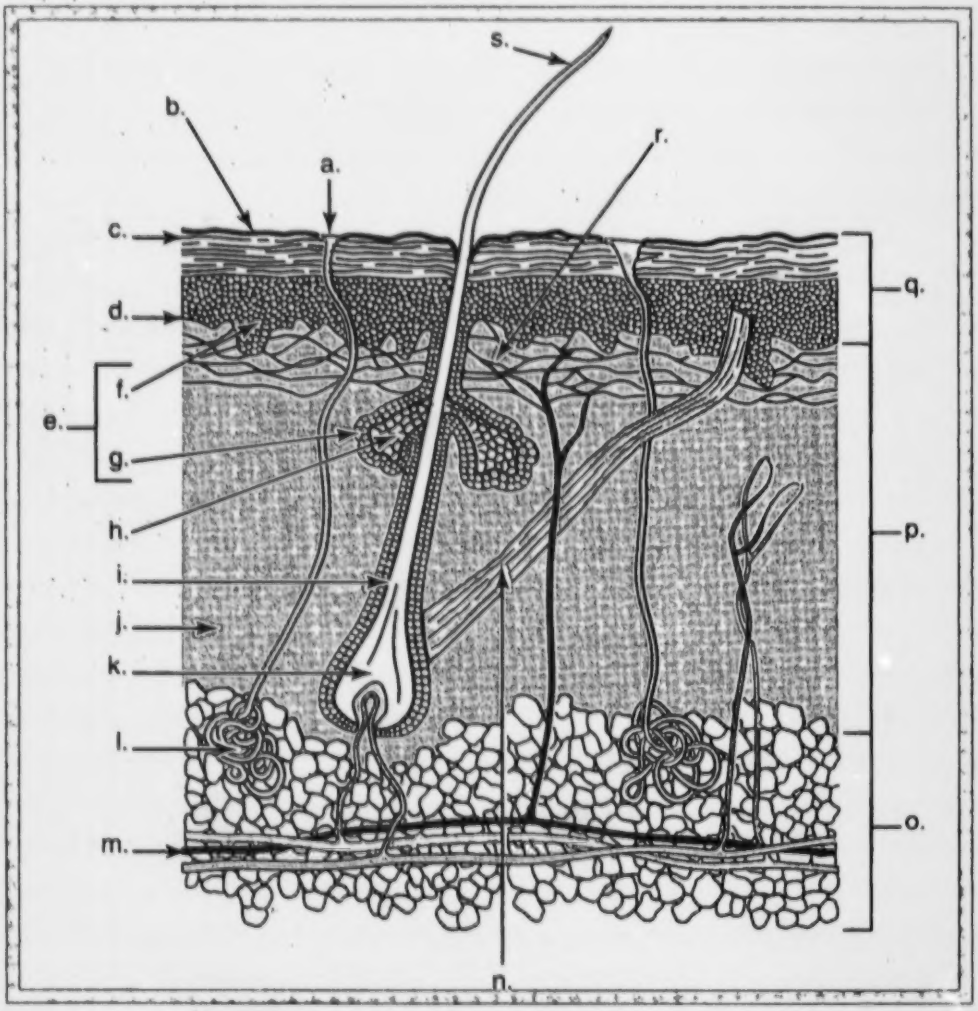
c. _____

d. _____

e. _____

Objective 13

Label the major structures of the integument. Write your answers on the blank lines provided below each of the following illustrations.



a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____
h. _____
i. _____
j. _____
k. _____
l. _____
m. _____
n. _____
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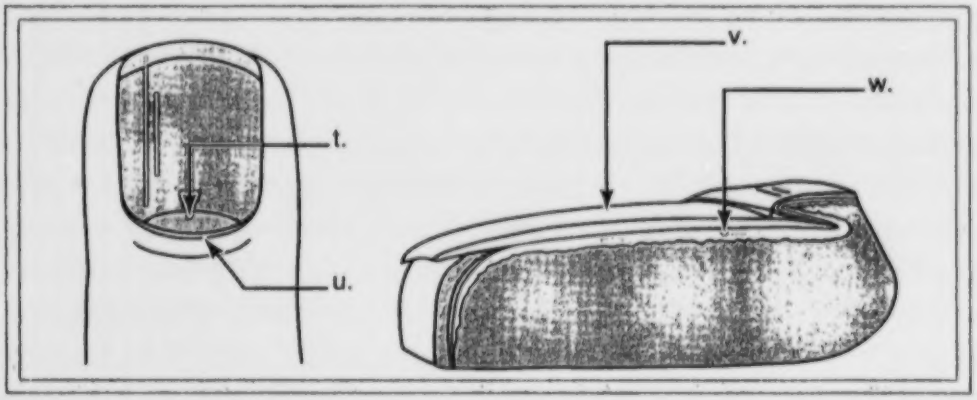
q. _____
r. _____
s. _____



t. _____ v. _____

u. _____ w. _____

Objective 14 Match common disorders and abnormalities of the integument to their correct definitions. Write the numbers on the blanks provided.

1. Acne
2. Cyst
3. Decubitus ulcer
4. Fissure
5. Furuncle
6. Hive
7. Nodule
8. Onycholysis
9. Paronychia
10. Polyp
11. Pustule
12. Ulcer
13. Vesicle

_____ a. A loss of substance on a cutaneous or mucous surface

_____ b. A pressure sore that is frequently found on the sacrum, elbows, and heels

_____ c. A small, solid, irregularly shaped cluster of cells

_____ d. A growth that extends into the lumen of a mucous membrane or appears on the skin

_____ e. A blister

_____ f. An inflammation and infection of the dermis and subcutaneous tissue caused by bacteria that enter the skin through a hair follicle; a boil

_____ g. An infection of the fold of the skin at the margin of a nail

_____ h. A sac that contains any fluid substance other than pus

_____ i. A cleft or groove in the skin or tissue

_____ j. A suddenly appearing raised patch that is usually redder than the surrounding skin; is often accompanied by severe itching; and is usually caused by an allergic reaction, infection, or stress

_____ k. A condition of the nail separating from the nail bed, usually caused by stress to long nails

_____ l. An infection and inflammation of the sebaceous glands

_____ m. An elevation of skin filled with pus

Answers to Written Test

Objective 1

The structures that cover the exposed surfaces of the body

Objective 2

Answers may appear in any order.

a. Skin
b. Auxiliary appendages

Objective 3

a. organ
b. depth
c. disease
d. mucous
e. melanin; blood

Objective 4

Answers may appear in any order.

a. Provides a mechanical barrier against microorganisms, sunlight, and chemicals to protect the body
b. Houses nerve endings that sense pain, temperature, touch, and pressure
c. Helps to regulate body temperature
d. Excretes waste materials
e. Helps maintain fluid and electrolyte balance

Objective 5

a. The thin, nonvascular, nonsensitive outermost layer of the skin, consisting of stratified squamous epithelial tissue and including as the greater part of its thickness dead cells that are scraped off and replaced by the underlying cells
b. The thick, vascular, sensitive layer of the skin just below the epidermis, consisting of dense, fibrous connective tissue and containing the auxiliary appendages of the skin
c. A polysaccharide gel with fibrous structures that serve as a cement to hold the layers of the skin together
d. The layer of areolar tissue and fat that lies beneath the dermis and exhibits varying amounts of fat content depending on factors such as body location, gender, nutrition, and health

Objective 6

a. 4
b. 1
c. 2
d. 5
e. 3

Objective 7

a. R

Objective 8

A formation of specialized cells within the skin that performs a particular function

Objective 9

a. germinativum; papilla; capillaries
b. Arrector pili
c. shaft; root
d. pigment
e. sebum
f. penis; contact
g. dust; foreign
h. ½

Objective 10

a. keratin
b. lunula
c. subungual
d. cuticle

Objective 11

a. Secrete sebum to lubricate and soften hair shafts; prevent excessive water evaporation and water absorption through the skin; lessen the amount of heat lost through the skin

b. Help to maintain homeostasis of fluids and electrolytes and body temperature; excrete nitrogenous wastes

c. Secrete cerumen

Objective 12

Answers may appear in any order.

a. Touch
b. Pressure
c. Heat
d. Cold
e. Pain

Objective 13

a. Pore
b. Stratum corneum
c. Stratum granulosum
d. Dermal-epidermal junction
e. Stratum germinativum
f. Stratum spinosum
g. Stratum basale
h. Sebaceous gland
i. Hair follicle
j. Reticular layer
k. Hair root
l. Sweat gland
m. Nerve
n. Arrector pili muscle
o. Hypodermis
p. Dermis
q. Epidermis
r. Papilla
s. Hair shaft
t. Lunula
u. Cuticle
v. Nail
w. Subungual area

Objective 14

a. 12	d. 10	g. 9	j. 6	m. 11
b. 3	e. 13	h. 2	k. 8	
c. 7	f. 5	i. 4	l. 1	

Answers to Assignment Sheets

Assignment Sheet 1

Suggested answers

Investigation Point 1

Approximately 95 percent of skin cancers are benign. However, melanoma can spread through the lymphatic system and the circulatory system, where it can affect other organs. Melanoma often spreads to the lungs, liver, and brain. Melanoma that metastasizes to other organs generally leads to death in three to six months, with only a five percent survival rate after five years.

Investigation Point 2

Many skin cancers appear to be caused by exposure to ultraviolet (UV) rays, including the ultraviolet rays in sunlight. Since the 1960s, many persons have engaged in outdoor activities, deliberately exposing themselves to UV radiation, especially through sunbathing and tanning booths. Australia is theorized to be especially hard hit because so many of its people lead active outdoor lives and because the widening hole in the ozone layer over the southern hemisphere increases Australia's exposure to UV radiation.

Investigation Point 3

The ABCDs of mole appearance include the following:

Asymmetry—Moles are normally shaped so that the two halves look alike; moles that are asymmetrical are more likely to be cancerous.

Border—Benign moles normally have clearly defined boundaries; malignant lesions often have irregular or indefinite boundaries.

Color—Moles come in a variety of colors; cancerous nevi often are very dark or show a mixture of colors, often including white patches.

Diameter—Normal nevi tend to be ¼ inch (6 millimeters) or less in diameter; cancerous nevi are often large in diameter and may appear as large patches.

Assignment Sheet 2

Suggested answers

Investigation Point 1

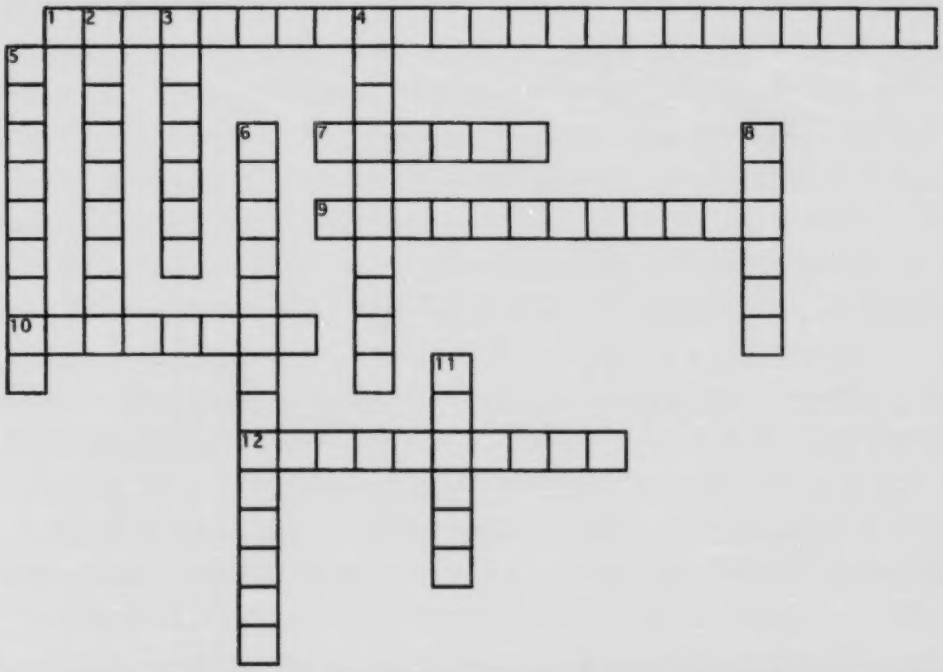
First-degree burns generally cause reddening of the skin. There is no blistering. Second-degree burns involve deep epidermal tissues and cause damage to the dermis and other skin structures. However, damage is not permanent and the skin and structures generally heal completely. Blisters, severe pain, and swelling are likely following the burn and healing is likely to produce scars. Third-degree burns involve destruction of the epidermis and dermis and can extend into much deeper tissues. Pain is minimized in third-degree burns due to the destruction of nerve tissues. Healing may be difficult and scarring is highly probable.

Investigation Point 2

Evaluated to the instructor's satisfaction based on facility procedures.

Crossword Puzzle 1—Terms from Objectives 1 Through 5

Name _____ Date _____



ACROSS

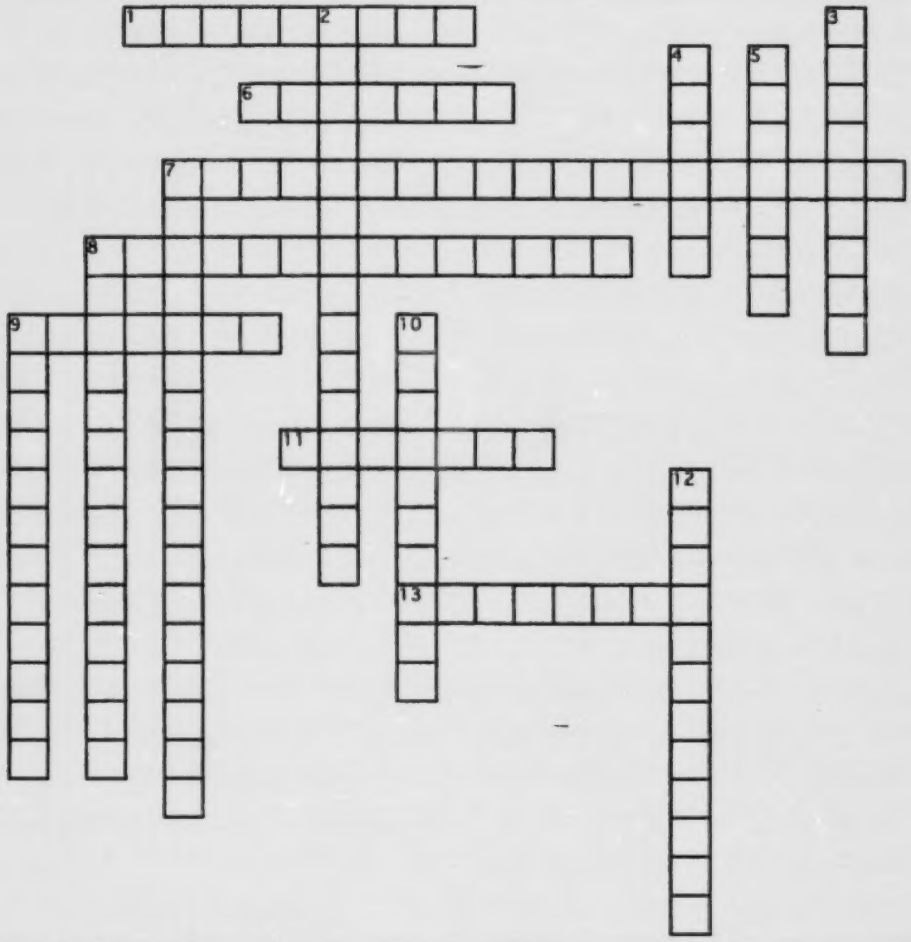
1. A polysaccharide gel with fibrous structures that serve as cement to hold the layers of the skin together (2 words)
7. The thick, vascular, sensitive layer of the skin just below the epidermis, consisting of dense, fibrous connective tissue and containing the auxiliary appendages of the skin
9. Beneath the skin
10. Containing blood or lymph vessels
12. The layer of areolar tissue and fat that lies beneath the dermis and exhibits varying amounts of fat content depending on factors such as body location, gender, nutrition, and health

DOWN

2. The thin, nonvascular, nonsensitive outermost layer of the skin, consisting of stratified squamous epithelial tissue and including as the greater part of its thickness dead cells that are scraped off and replaced by the underlying cells
3. A protein that absorbs ultraviolet light to give coloration to body structures; also referred to as a *pigment*
4. The structures that cover the exposed surfaces of the body
5. Containing nerve endings and, therefore, can feel sensation
6. A carbohydrate that contains three or more molecules of simple carbohydrates
8. The fibrous connective tissue of the body
11. A small space or a cavity within a tissue

Crossword Puzzle 2—Terms from Objective 6

Name _____ Date _____



ACROSS

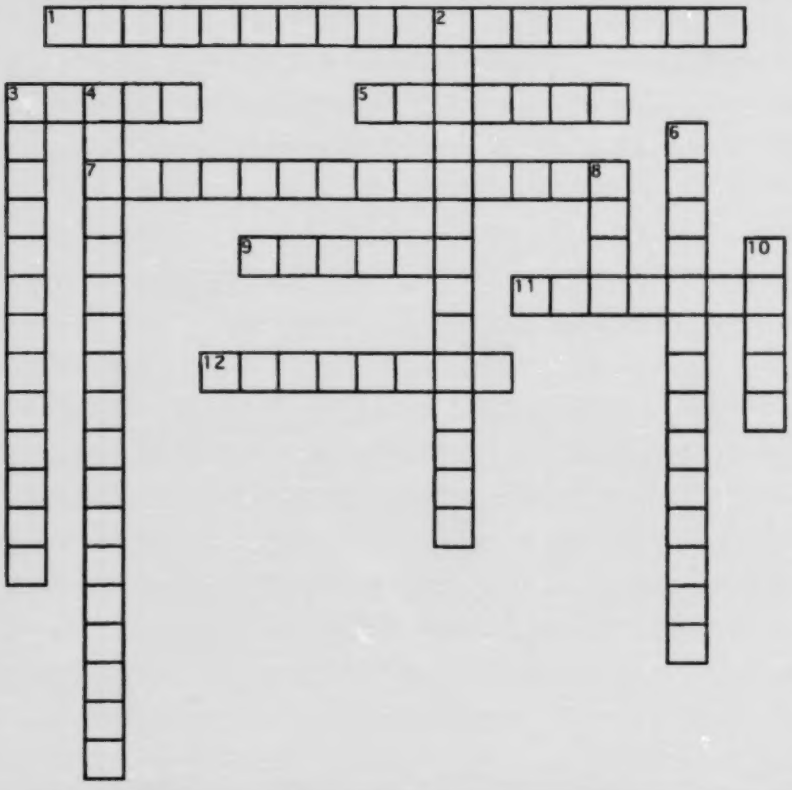
1. A small, circular, dense area within the intercellular bridge that forms the site of adhesion between certain epithelial cells, especially of the epidermis
6. The Latin term for "layer"
7. The innermost layer of the epidermis where columnar cells continually undergo mitosis to make new cells and push older cells outward (2 words)
8. The outermost layer of the epidermis where dead cells have been converted into keratin that continually flakes off (2 words)
9. A fibrous, sulfur-containing protein that is the primary component of the epidermis, hair, nails, and enamel of the teeth
11. The Latin term for "horn"
13. The Latin term for "spiny"

DOWN

2. The keratin-synthesizing inner layer of the epidermis characterized by pronounced desmosomes that give the appearance of spikes running between the cells (2 words)
3. A substance from which another substance is formed; a condition that leads to another condition
4. The Latin term for "base layer"
5. The Latin term for "clear"
7. The inner layer of the epidermis with dying cells that develop granules of keratohyalin in their cytoplasm (2 words)
8. The water-repellent, transparent inner layer of the epidermis found only on the palms of the hands and the soles of the feet (2 words)
9. A precursor for keratin
10. The Latin term for "granular"
12. The Latin term for "germination"

Crossword Puzzle 3—Terms from Objectives 7 Through 10

Name _____ Date _____



ACROSS

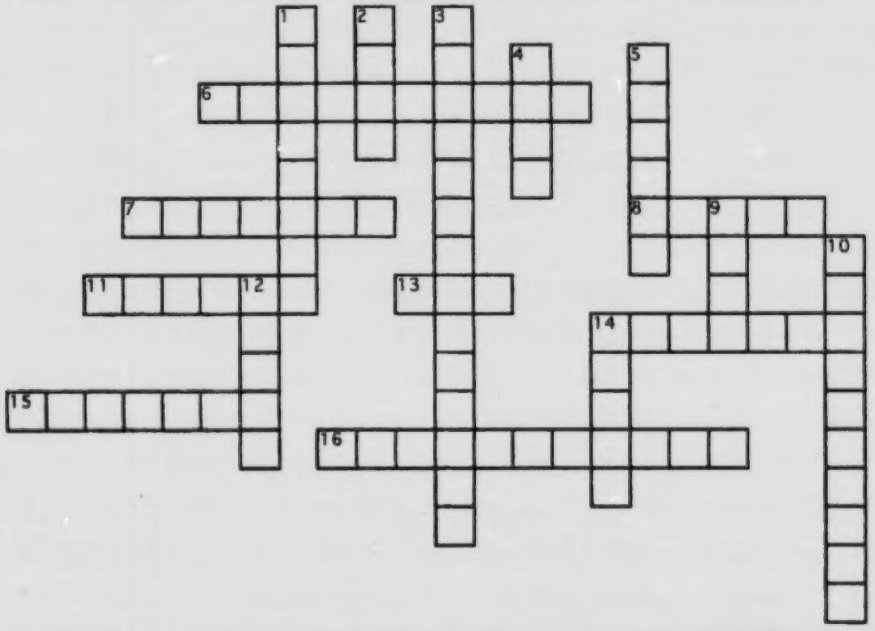
1. A formation of specialized cells within the skin that performs a particular function (2 words)
3. The part of a hair that protrudes from the skin
5. A protrusion that extends into the epidermal area
7. The inner layer of the dermis that forms a network of interlacing cells and fibers, making this layer tough and elastic (2 words)
9. The Latin term meaning "little moon"; the crescent-shaped white area at the base of a nail
11. The thin edge of cornified epithelium at the base of a nail
12. A tube that extends from the dermis through the epidermis and to the surface of the skin

DOWN

2. The outer layer of the dermis that lies next to the basal layer of the epidermis and is patterned with papillae and hollows (2 words)
3. The region under a nail; the nail bed (2 words)
4. Bundles of involuntary muscle fiber that contract against the follicle when the skin is cold or during certain emotional states, causing the hair shaft to stand upright; also called *pilomotor muscle* (3 words)
6. The gland that is connected to the dermal shaft that surrounds the root of a hair (2 words)
8. The subdermal section of a hair
10. The oily secretion of the sebaceous glands of the skin; composed of keratin, fat, and cellular debris

Crossword Puzzle 4—Terms from Objectives 11 Through 14

Name _____ Date _____



ACROSS

6. An infection of the fold of skin at the margin of a nail
7. A blister
8. A loss of substance on a cutaneous or mucous surface
11. A small, solid, irregularly shaped cluster of cells
13. An accumulation of white blood cells, pathogens, dead or damaged cells, and other substances associated with an infection
14. An elevation of skin filled with pus
15. A cleft or groove in the skin or tissue
16. A condition of the nail separating from the nail bed, usually caused by stress to long nails

DOWN

1. An inflammation and infection of the dermis and subcutaneous tissue caused by bacteria that enter the skin through a hair follicle; a boil
2. An infection and inflammation of the sebaceous glands
3. A pressure sore that is frequently found on the sacrum, elbows, and heels (2 words)
4. A suddenly appearing raised patch that is usually redder than the surrounding skin; is often accompanied by severe itching; and is usually caused by an allergic reaction, infection, or stress
5. The large, triangular bone at the dorsal part of the pelvis, inserted like a wedge between the two hip bones
9. A sac that contains any fluid substance other than pus
10. A small structure located in the deep layers of the dermis with a duct that exits through a pore in the epidermis; the gland consists of a coiled tube surrounded by capillaries (2 words)
12. A cavity, especially in a tubular organ or structure
14. A growth that extends into the lumen of a mucous membrane or appears on the skin

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. DERMAL-EPIDERMAL JUNCTION
7. DERMIS
9. SUBCUTANEOUS
10. VASCULAR
12. HYPODERMIS

DOWN
2. EPIDERMIS
3. MELANIN
4. INTEGUMENT
5. SENSITIVE
6. POLYSACCHARIDE
8. FASCIA
11. AREOLA

Crossword Puzzle 2

ACROSS
1. DESMOSOME
6. STRATUM
7. STRATUM GERMINATIVUM
8. STRATUM CORNEUM
9. KERATIN
11. CORNEUM
13. SPINOSUM

DOWN
2. STRATUM SPINOSUM
3. PRECURSOR
4. BASALE
5. LUCIDUM
7. STRATUM GRANULOSUM
8. STRATUM LUCIDUM
9. KERATOHYALIN
10. GRANULOSUM
12. GERMINATIVUM

Crossword Puzzle 3

ACROSS
1. AUXILIARY APPENDAGE
3. SHAFT
5. PAPILLA
7. RETICULAR LAYER
9. LUNULA
11. CUTICLE
12. FOLLICLE

DOWN
2. PAPILLARY LAYER
3. SUBUNGUAL AREA
4. ARRECTOR PILI MUSCLE
6. SEBACEOUS GLAND
8. ROOT
10. SEBUM

Crossword Puzzle 4

ACROSS
6. PARONYCHIA
7. VESICLE
8. ULCER
11. NODULE
13. PUS
14. PUSTULE
15. FISSURE
16. ONYCHOLYSIS

DOWN
1. FURUNCLE
2. ACNE
3. DECUBITUS ULCER
4. HIVE
5. SACRUM
9. CYST
10. SWEAT GLAND
12. LUMEN
14. POLYP

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 9

1. An oily secretion composed of keratin, fat, and cellular debris is the _____.
   a. nitrogenous waste
   b. cerumen
   c. paronychia
   d. sebum

Objective 14

2. A loss of substance on a cutaneous or mucous surface is called an _____.
   a. *ulcer*
   b. *ungual lesion*
   c. *urticaria*
   d. *acne fissure*

Objective 14

3. An inflammation and infection of the dermis and subcutaneous tissue caused by bacteria that enter the skin through a hair follicle is called a _____.
   a. *cyst*
   b. *furuncle*
   c. *nodule*
   d. *follicular ulcer*

Objective 10

4. Nails consist of epidermal cells that have been converted to _____.
   a. keratin
   b. melanin
   c. cerumen
   d. lanolin

Objective 7

5. The papillary layer is patterned with _____.
   a. papillae and gland ducts
   b. papillae and hollows
   c. arrector pili and gland ducts
   d. arrector pili and hollows

Objective 3

6. Which of the following statements is NOT correct with regard to skin?
   a. The skin is the largest organ of the body.
   b. Skin varies in depth over the body.
   c. If skin is kept clean, it is the body's first line of defense against disease.
   d. The skin connects to serous membranes where it joins body cavities.

Objective 1

7. The _____ is the structures that cover the exposed surfaces of the body.
   a. melanin
   b. keratin
   c. lymph
   d. integument

Objective 5

8. Which of the following is NOT a correct statement?
   a. The dermis is vascular.
   b. The dermis is nonsensitive.
   c. The greater part of the thickness of the epidermis is dead cells.
   d. The epidermis consists of stratified squamous epithelial tissue.

Objective 7

9. Which of the following is NOT a correct statement?
   a. The reticular layer of the dermis forms a network of interlacing cells and fibers.
   b. The reticular layer is the inner layer of the dermis.
   c. The papillary layer lies next to the basal layer of the epidermis.
   d. The papillary layer contains cementing substances to form the dermal-epidermal junction so that a separate membrane is not required.

Objective 8

10. A formation of specialized cells within the skin that performs a particular function is called _____.

    a. an *axilla*

    b. a *papilla*

    c. an *auxiliary appendage*

    d. a *papillary appendage*

Objective 9

11. Hair grows from a _____ in the skin.

    a. follicle

    b. pore

    c. lumen

    d. furuncle

Objective 11

12. Which of the following phrases is NOT a function of the sebaceous glands?

    a. secrete sebum to lubricate and soften hair shafts

    b. prevent excessive water evaporation and water absorption through the skin

    c. lessen the amount of heat lost through the skin

    d. secrete toxins that reduce the populations of pathogens on the skin

Objective 5

13. Which of the following statements is NOT correct about the hypodermis?

    a. The hypodermis is also called the *subcutaneous fascia*.

    b. The hypodermis lies between the dermis and the epidermis.

    c. The hypodermis consists of areolar tissue and fat.

    d. The hypodermis exhibits varying amounts of fat content depending on factors such as body location, gender, nutrition, and health.

Objective 14

14. A growth that extends into the lumen of a mucous membrane is called a _____.

    a. *boil*

    b. *polyp*

    c. *fissure*

    d. *vesicle*

Objective 6

15. _____ is a fibrous, sulfur-containing protein that is the primary component of the epidermis, hair, nails, and enamel of the teeth.

a. Stratum corneum

b. Stratum lucidum

c. Keratin

d. Keratohyalin

Objective 13

16. The structure indicated by the letter "W" in the illustration on the next page is a _____.

a. hair follicle

b. hair root

c. papilla

d. sebaceous gland

Objective 13

17. The structure indicated by the letter "X" in the illustration on the next page is a _____.

a. follicle

b. pore

c. sweat gland

d. papilla

Objective 13

18. The structure indicated by the letter "Y" in the illustration on the next page is _____.

a. an arrector pili muscle

b. a pore

c. a papilla

d. a nerve

Objective 13

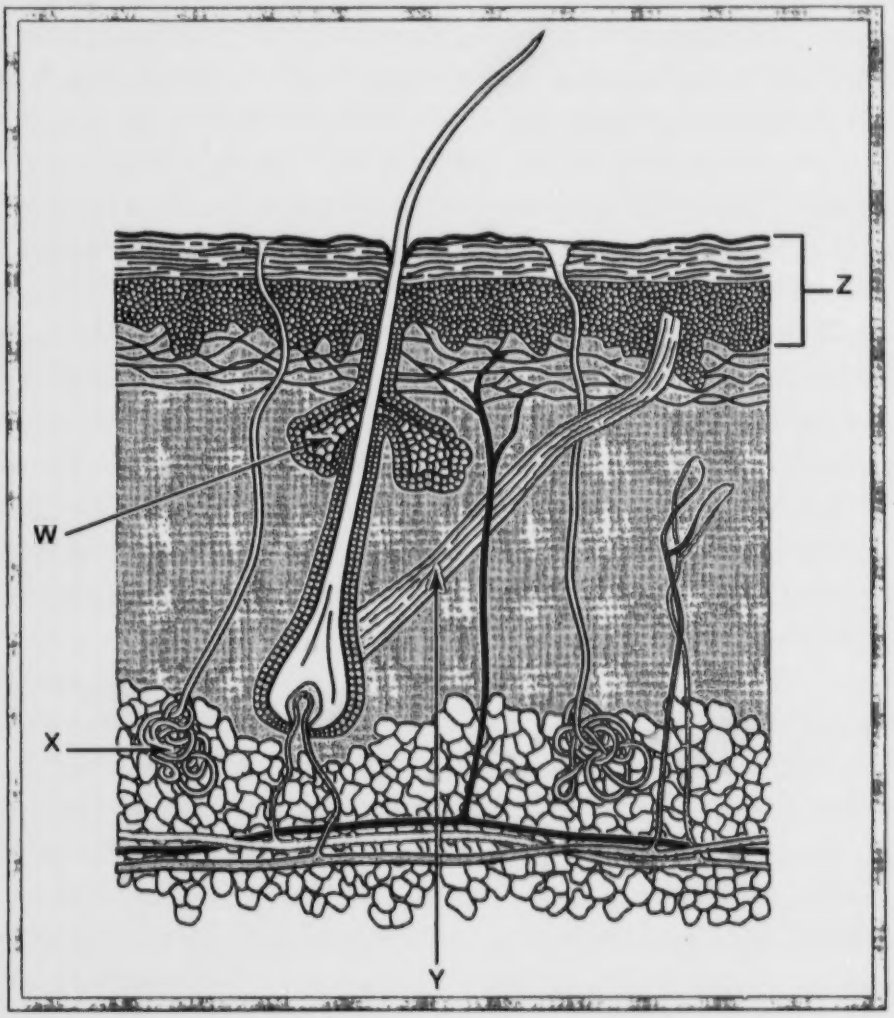
19. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

a. stratum granulosum

b. stratum basale

c. epidermis

d. reticular layer



Objective 14

20. A sac that contains any fluid substance other than pus is called a _____.

a. *boil*

b. *vesicle*

c. *polyp*

d. *cyst*

Objective 5

21. The term *vascular* means _____.

a. containing blood or lymph vessels

b. containing nerve endings

c. containing molecules of simple carbohydrates

d. containing pus

Objective 13

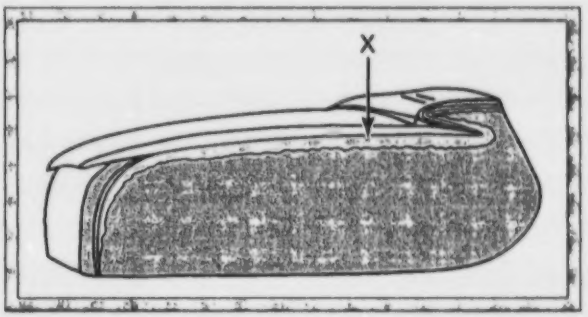
22. The structure indicated by the letter "X" in the illustration below is the _____ area of a nail.

    a. cuticle

    b. subungual

    c. lucidum

    d. lunula



Objective 6

23. The Latin term for "horn" is _____.

    a. stratum

    b. corneum

    c. lucidum

    d. granulosum

Objective 14

24. An infection of the fold of skin at the margin of a nail is called _____.

    a. a *paroxysm*

    b. an *onycholysis*

    c. a *paronychia*

    d. an *urticaria*

Objective 11

25. Which of the following is NOT a true statement about sweat glands?

    a. Sweat glands consist of a coiled tube surrounded by capillaries.

    b. Sweat glands are located in the deep layers of the dermis with ducts that exit through pores in the epidermis.

    c. Sweat glands help to maintain homeostasis of fluids and electrolytes and body temperature.

    d. Sweat glands excrete hydrogenous wastes.

Objective 9

26. The eyelashes, nasal hairs, and hair on the ears _____.

a. serve no useful purpose

b. are not the same structure and composition as hair on the rest of the body

c. provide some level of protection against dust and foreign matter

d. do not require sebaceous glands because of the lacrimal glands, mucous membrane, and ceruminous glands

Objective 6

27. The _____ is found only on the palms of the hands and the soles of the feet.

a. stratum basale

b. stratum lucidum

c. stratum granulosum

d. stratum germinativum

Objective 4

28. Which of the following phrases is NOT a function of the skin?

a. provides a mechanical barrier against microorganisms, sunlight, and chemicals to protect the body

b. houses nerve endings that sense pain, temperature, touch, and pressure

c. helps to regulate body temperature and to maintain fluid and electrolyte balance

d. stores waste materials for later excretion through the urinary tract

Objective 2

29. The skin and the auxiliary appendages are the two major structures that make up the _____.

a. melanin

b. keratin

c. lymph

d. integument

Objective 5

30. The dermis consists of _____.

a. dense, fibrous connective tissue

b. stratified squamous epithelial tissue

c. stratified squamous connective tissue

d. dense, fibrous epithelial tissue

Objective 9

31. A hair consists of a part that protrudes from the skin—called the _____—and a subdermal section—called the _____.

    a. *root; shaft*

    b. *shaft; root*

    c. *base; strand*

    d. *strand; base*

Objective 14

32. A condition of the nail separating from the nail bed, usually caused by stress to long nails, is called _____.

    a. *paroxysm*

    b. *onycholysis*

    c. *paronychia*

    d. *urticaria*

Objective 12

33. The nerve endings found in the skin sense _____.

    a. touch, pressure, heat, cold, and pain

    b. touch, heat, cold, and pain

    c. touch, heat, and pain

    d. touch and pain

Objective 14

34. A small, solid, irregularly shaped cluster of cells is called _____.

    a. a *nodule*

    b. a *boil*

    c. a *follicle*

    d. an *auxiliary appendage*

Objective 6

35. _____ is the Latin term for "layer."

    a. Stratum

    b. Corneum

    c. Lucidum

    d. Granulosum

Objective 3

36. A protein that absorbs ultraviolet light to give coloration to body structures is _____.

    a. dermal-epidermal
    b. areola
    c. fascia
    d. melanin

Objective 14

37. A cleft or groove in the skin or tissue is called a _____.

    a. *fissure*
    b. *papilla*
    c. *hollow*
    d. *reticulum*

Objective 6

38. The Latin term for "granular" is _____.

    a. stratum
    b. corneum
    c. lucidum
    d. granulosum

Objective 9

39. A tube that extends from the dermis through the epidermis and to the surface of the skin is a _____.

    a. desmosome
    b. follicle
    c. papilla
    d. basale

Objective 14

40. A pustule is _____.

    a. an inflamed nail bed that exudes pus
    b. a pus-filled hair follicle
    c. an elevation of skin filled with pus
    d. a cavity of skin filled with pus

Objective 5

41. The _____ is the thin, nonvascular, nonsensitive outermost layer of the skin.

a. epidermis

b. dermis

c. peridermis

d. subdermis

Objective 9

42. Hair is kept soft by _____ that is secreted by two or more _____ glands.

a. papillum; papillary

b. sweat; sweat

c. serum; serous

d. sebum; sebaceous

Objective 5

43. The hypodermis consists of _____.

a. dense, fibrous connective tissue

b. dense, fibrous epithelial tissue

c. areolar tissue and fat

d. areolar tissue and connective tissue

Objective 6

44. In the stratum corneum, _____.

a. columnar cells continually undergo mitosis to make new cells and push older cells outward

b. the skin connects to the cornea of the eye

c. dead cells have been converted into keratin that flakes off

d. new cells for hair follicles are produced

Objective 9

45. Hair is found on all outer parts of the body except the penis and _____.

a. the contact areas of the hands and feet

b. the eyelids

c. the tongue

d. the ears

Objective 5

46. The dermis contains _____.

a. auxiliary appendages

b. stratum corneum

c. stratum lucidum

d. stratum spinosum

Objective 14

47. _____ is an infection and inflammation of the sebaceous glands.

a. Sebum

b. Sebaceosis

c. Acne

d. Decubitus

Objective 6

48. The Latin term for "clear" is _____.

a. stratum

b. corneum

c. lucidum

d. granulosum

Objective 14

49. A blister is also called a _____.

a. *furuncle*

b. *fissure*

c. *polyp*

d. *vesicle*

Objective 10

50. Nails grow from _____ cells lying under the _____ at the proximal end of a nail.

a. epithelial; cuticle

b. epithelial; lunula

c. connective tissue; cuticle

d. connective tissue; lunula

Objective 14

51. A _____ is a pressure sore that is frequently found on the sacrum, elbows, and heels.

a. dermititis ulcer

b. pustule

c. cyst

d. decubitus ulcer

Objective 10

52. The region under a nail is called the _____ *area* or the *nail bed.*

a. *subdermal*

b. *sublingual*

c. *subordinal*

d. *subungual*

Objective 14

53. A suddenly appearing raised patch that is usually redder than the surrounding skin; is often accompanied by severe itching; and is usually caused by an allergic reaction, infection, or stress is called a _____.

a. *hive*

b. *furuncle*

c. *fissuration*

d. *ulceration*

Objective 3

54. Skin color is the result of _____ and the amount of _____ near the surface of the skin.

a. melanin; lymph

b. melanin; blood

c. keratin; lymph

d. keratin; blood

Objective 13

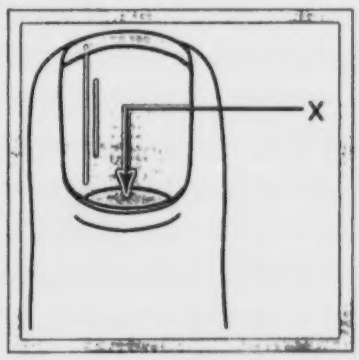
55. The structure indicated by the letter "X" in the illustration below is _____ of a nail.

a. the cuticle

b. the lunula

c. the subungual area

d. the lucidium



Answers to Module Review

1. d	12. d	23. b	34. a	45. a
2. a	13. b	24. c	35. a	46. a
3. b	14. b	25. d	36. d	47. c
4. a	15. c	26. c	37. a	48. c
5. b	16. d	27. b	38. d	49. d
6. d	17. c	28. d	39. b	50. b
7. d	18. a	29. d	40. c	51. d
8. b	19. c	30. a	41. a	52. d
9. d	20. d	31. b	42. d	53. a
10. c	21. a	32. b	43. c	54. b
11. a	22. b	33. a	44. c	55. b

MODULE SET II:
Major Body Systems

Module 2: Skeletal System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Skeletal System	9
2—Major Structures of a Long Bone	11
3—Cavities and Processes of Bones	13
4—Cavities and Processes of Bones (cont.)	15
5—Cavities and Processes of Bones (cont.)	17
6—Cavities and Processes of Bones (cont.)	19
7—Major Components of the Anterior and Posterior Axial Skeleton	21
8—Major Bones of the Anterior and Posterior Appendicular Skeleton	23
9—Major Bones and Structures of the Cranium	25
10—Major Bones and Structures of the Face	27
11—Major Bones of the Ear	29
12—Regions and Major Bones and Structures of the Vertebral Column	31
13—Major Bones and Structures of the Ribs and Sternum	33
14—Major Bones and Structures of the Ribs and Sternum (cont.)	35
15—Articular Cartilage	37
Written Test	39
Answers to Written Test	61
Answers to Assignment Sheets	69
Crossword Puzzles	
1—Terms from Objectives 1 Through 6	71
2—Terms from Objectives 7 Through 9	73
3—Terms from Objectives 10 Through 13	75
4—Terms from Objective 14	77
5—Terms from Objectives 16 Through 26	79
6—Terms from Objective 27	81
Answers to Crossword Puzzles	83
Module Review	85
Answers to Module Review	113

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 6 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 7 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining sections in the student edition: assignment sheets.
- Have students complete the assignment sheets.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** The skeletal system is distinct enough that many students will be somewhat familiar with it at a basic level, recognizing major bones much as they would recognize the shapes or locations of certain sites on a U.S. map. Use this knowledge to introduce the module and bolster the confidence of the class by using a model or illustration to allow the students to name bones that they recognize. This, of course, addresses the anatomy aspect of the presentation to a degree. Build on that with the physiological aspects of the skeletal system.

- Use skeletal models or other illustrations to play a game in which the students name bones of the skeletal system. A number of formats are possible, depending on how competitive you want to make the activity. For example, each student can play as an individual using a "spelling bee" format. Rotate through the class in order, asking individuals in turn to identify bones. If a student fails to identify the bone correctly, then that student is eliminated and the next player gets an opportunity to identify the same bone until only one student remains and is able to identify the next bone. Another format for individual play would be to use a *Who Wants to Be a Millionaire* format, where students get so many points (dollars) for correct answers, until the entire class has had an opportunity to accumulate points. Alternatively, the class can be divided into teams. *Family Feud* and *College Bowl* formats work well for this competition so that team members can confer on some questions. In these and other approaches, you may choose to draw the names of bones at random to avoid the appearance of prejudices, using multiple pools of names to account for differences in difficulty. Also, you may choose to provide the students with the name and have them identify the bone on the illustration or model or point to a bone and have the student supply the name or use a combination of these techniques.

  ✔ **NOTE:** Throughout the presentation, use the medical terms for individual bones so that the students will get used to them through gradual exposure. Early in the process, help the students by supplying common names with the preferred term, as in saying, "The femur or thighbone." Over the course of the presentation, offer less and less support through common terms.

- Obtain MRIs, CT scans, and radiographs that show skeletal-system components to support your presentation and to get the students used to dealing with these imaging presentations. If possible, include images showing abnormalities, such as broken bones, misaligned vertebrae, etc.
- Display bone cross-sections with osteoporosis.
- Use crossword puzzles 1 through 6 to help reinforce the terms in the associated objectives.

- To supplement Objective 1 and Objective 2, which define the term *skeletal system* and state the functions of the skeletal system, use a model or illustrations of the skeletal system to demonstrate the functions of the skeletal system. For example, ask the students if they recognize the human form in the skeleton. Show them how connected parts move. Indicate the locations of organs to show how they are protected. Use models or illustrations to position representative organs within the skeletal system. Discuss the production of blood cells and the importance of calcium and phosphorus to body functions.

- When discussing Objective 3, which distinguishes between the characteristics of bone and cartilage, show the students examples of bone and cartilage, including cross-sections. Obtain these from a butcher shop if other samples are not available. Indicate the locations and functions of cartilage within the body.

- When discussing Objective 4, which lists the components of bones, provide the students with fresh bones and dried bones, including some cut in cross-section, to allow them to compare weight, moisture content, marrow deterioration, etc. Discuss the roles of the components, such as the need for a moist field of marrow to allow blood-cell production and exchange with the circulatory system.

- For Objective 5, indicate the location and names of the various types of bones as classified by their location and structure. Do not indicate all examples of each type of bone, so that you can challenge the students to identify other examples. Discuss the structure of each type of bone and names of specific parts, such as the diaphysis and epiphysis. Relate structures to the purpose of each type of bone, such as how short bones provide flexibility while long bones provide rigidity and power. Discuss ossification as related to the patella, for example. Exhibit models, skeletons, or illustrations of the skeletal systems of mammals, birds, and legged reptiles to demonstrate the similarities in skeletal systems among various species and to allow students to observe and identify examples of the various types of bones in these different kinds of skeletons.

- Build on the previous objectives to discuss the structure of bone marrow, which is presented in Objective 6.

- Relate the previous objectives and the discussion of types of bones to the major structures of a long bone and the definitions of long bones, which are presented in Objective 7 through Objective 9. Use illustrations, imaging, models, and actual bones to support the objectives.

- Name and locate the various types of cavities and processes of bones discussed and illustrated in Objective 10. Again, where possible, leave examples for the students to discover and name. Emphasize the functional aspects of these structures.

- For Objective 11 through Objective 13, which describe the major divisions of the human skeleton, the major components of the anterior and posterior axial skeleton, and the major bones of the anterior and posterior appendicular skeleton, explain to the students that the 206 bones of the human skeleton are divided into two subsystems. Use an illustration or model with the two subsystems colored with two different colors to distinguish between them. By this point in the presentation, the class should have a good grasp of the medical terms associated with major bones. Provide the students with names of bones and have them state whether they are in the axial or appendicular skeleton.

- Provide the students with illustrations, models, or actual skulls to discuss the bones of the cranium, face, and ear, as presented in Objective 14 and Objective 15. Discuss how the skull is constructed to support its functions, to include protection of the brain and

operational support of the eyes, nose, ears, mouth, etc. Indicate the complexity of supporting these diverse functions. If available, provide a model of an infant's skull to show the fissures and fontanels. Continue the discussion of skull bones by covering the objective on the hyoid bone (Objective 16), using a model or actual bone if available.

- When discussing Objective 17 and Objective 18, which deal with the major regions and the major bones of the vertebral column, compare and contrast types of vertebrae. Help the students understand the designations given to the vertebrae. Allow the students to explore spinal-column components to discover how they fit together, range of motion, protection of the spinal cord, etc. Indicate the fused components.

- Discuss the structure of the ribs and sternum, as presented in Objective 19 and Objective 20. Ensure that students understand the numbering of the ribs and how the ribs join or do not join the sternum and each other.

- Discuss the functions and components of the articular system as presented in Objective 21 through Objective 23. Using joints from freshly butchered animals and dry bones, illustrate the difference between well-lubricated and poorly lubricated joints. Provide images of skeletal deformities related to impaired articular functions.

- Discuss the three types of articulations (joints), which are presented in Objective 24 through Objective 26. Provide the students with examples of each and then ask them to classify other joints. Ask why different types of joints are necessary to support body functions. Continue the discussion by covering types of freely moving joints and indicating examples of each.

- To supplement Objective 27, common disorders of the skeletal system, invite an orthopedic surgeon to meet with the class to talk about skeletal disorders and corrective procedures. Provide MRIs, X rays, and other images of abnormal and damaged skeletal structures. Provide actual examples for the class to examine if possible.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites provide information specifically about the skeletal system, though other pages within the web site may provide information about other systems. If more general information about anatomy and physiology is desired, refer to the supplemental resources in the first four modules in Module Set I.

- http://faculty.niagara.edu/bcliff/hapcstop.html

  The site listed contains case studies for a number of AST subject areas, including the skeletal system. The case studies are free to use as long as their source is acknowledged.

- http://www.orthop.washington.edu

  Sponsored by the University of Washington, this site offers information on orthopedic-related subjects and links to similar sites.

- http://www.rad.washington.edu/anatomy/index.html

  This site features radiological images of the body and the skeletal system.

- http://sorrel.humboldt.edu/~bioman/bones/bones.html

  This site provides interactive illustrations of the skeleton that allow students to view a skeleton without the bones labeled and then be able to click on one section at a time to see the bones labeled. This approach would be useful in self-study, in quizzing students, and in allowing students to drill each other.

- http://www.dhpc.adelaide.edu.au/projects/vishuman2/

  This site provides views of human body with various types of imaging available. Many of the images deal with the skeletal system.

- http://www.colorado.edu/physics/2000/xray/index.html

  This is an interesting lesson on x-ray procedures and their use in medical applications. The material is provided through an interactive presentation on X rays that includes a fluoroscope image of a human hand.

- http://www.rad.upenn.edu/rundle/InteractiveKnee.html

  This site deals only with the knee, but it does so with various types of imaging from various perspectives.

- http://www.scoi.com/

  This site provides information and illustrations of various skeletal regions with emphasis on joints.

- http://www.innerbody.com/htm/body.html

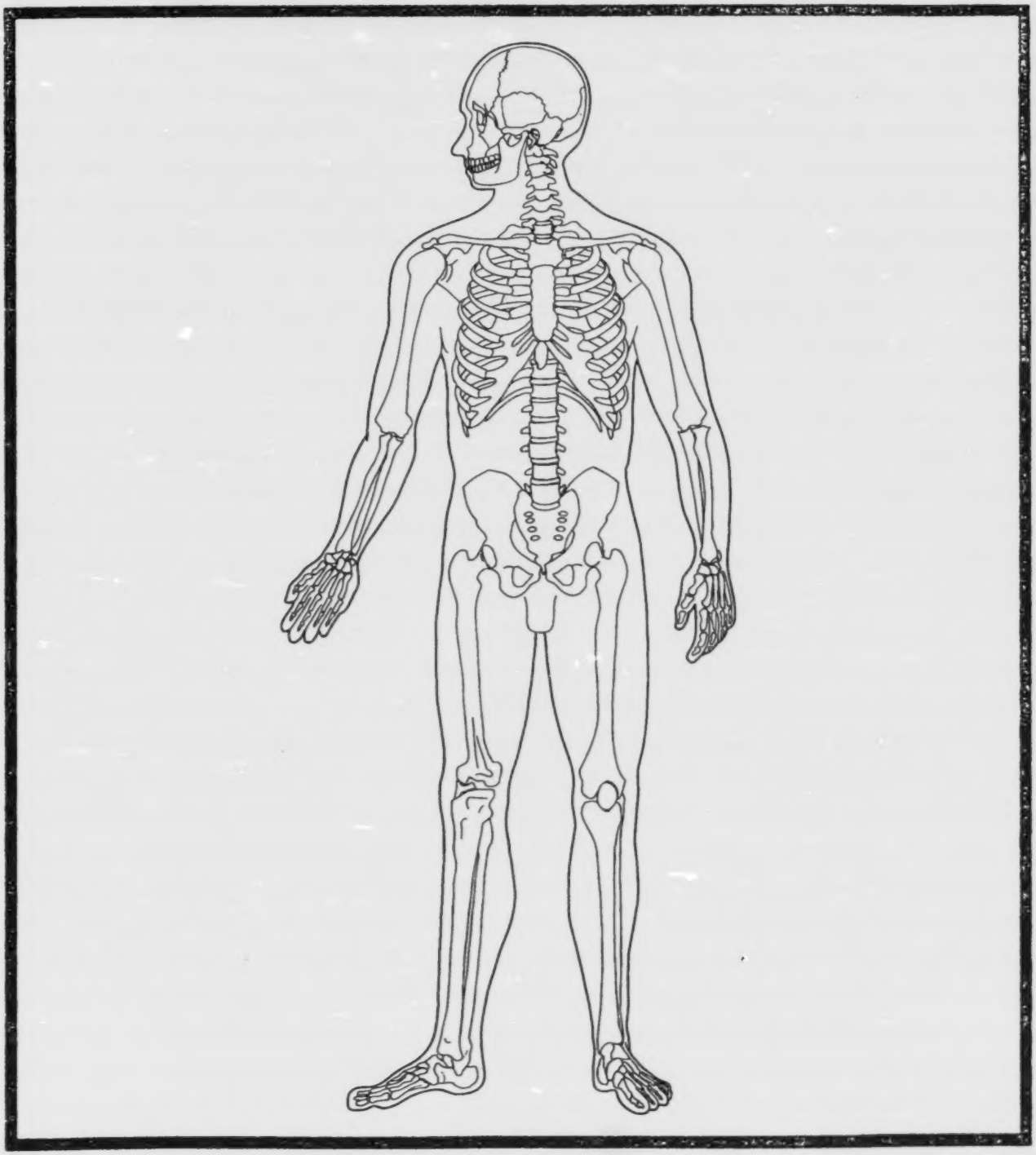
  This site features an interactive skeleton that shows labeling of select bones and articular components.

- http://www.csuchico.edu/anth/Module/skull.html

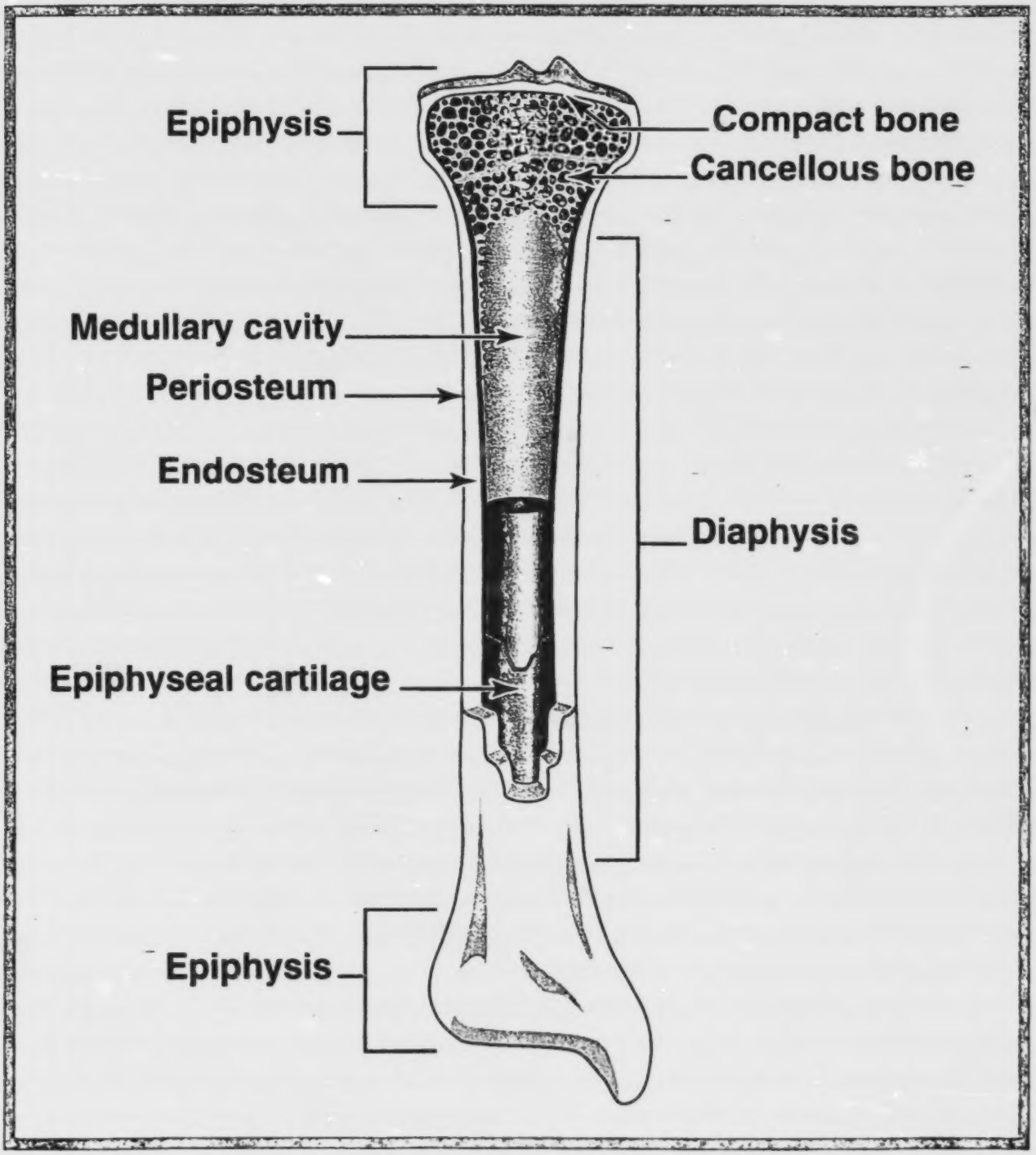
  The skull and its bones are the topic of this site. The presentation is interactive and includes a number of formats, including animation.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

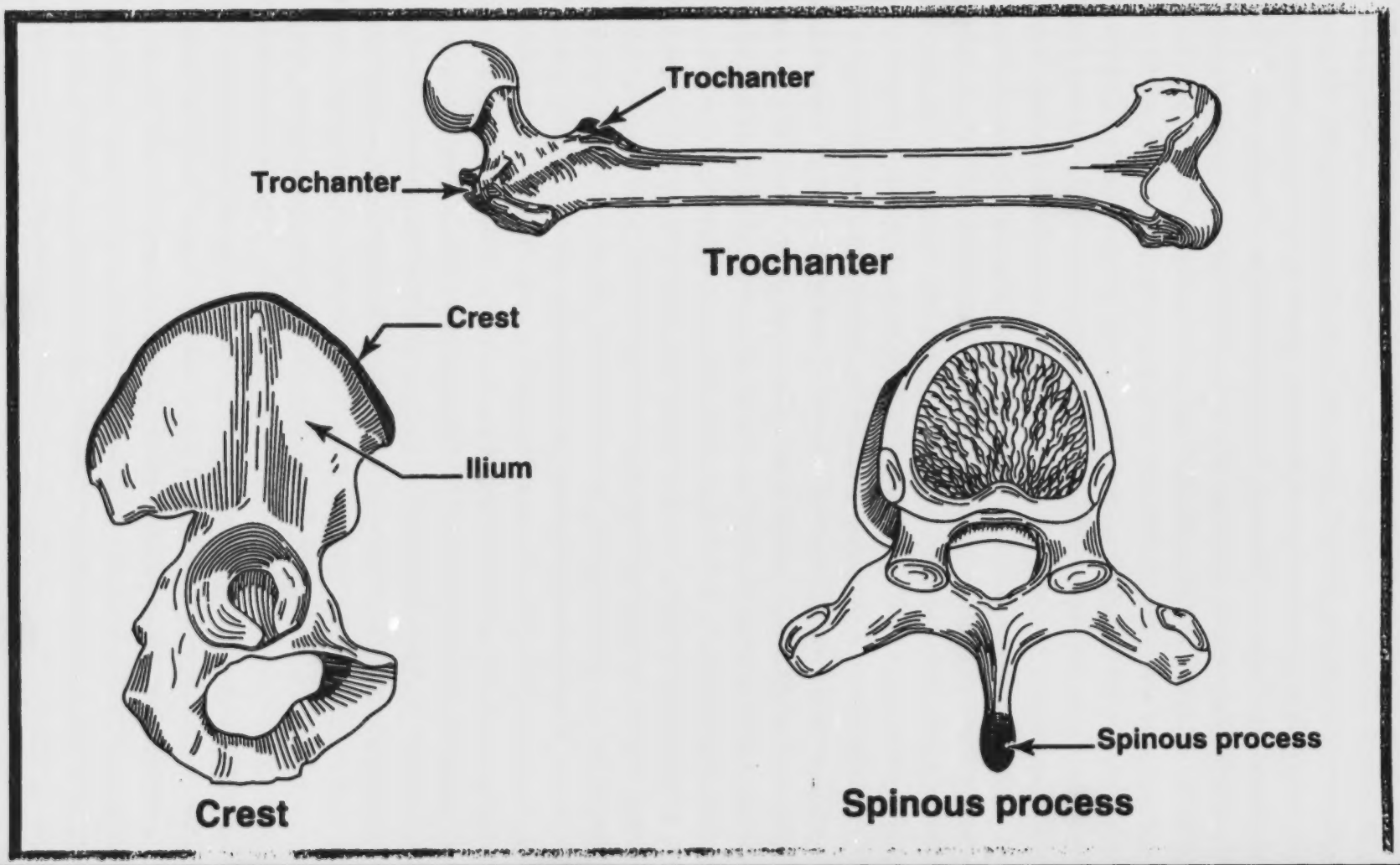
Skeletal System



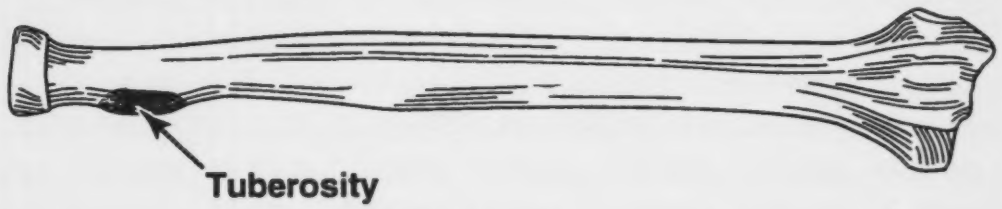
Major Structures of a Long Bone



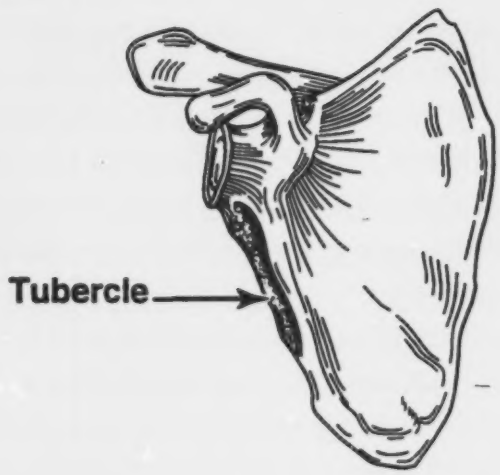
Cavities and Processes of Bones



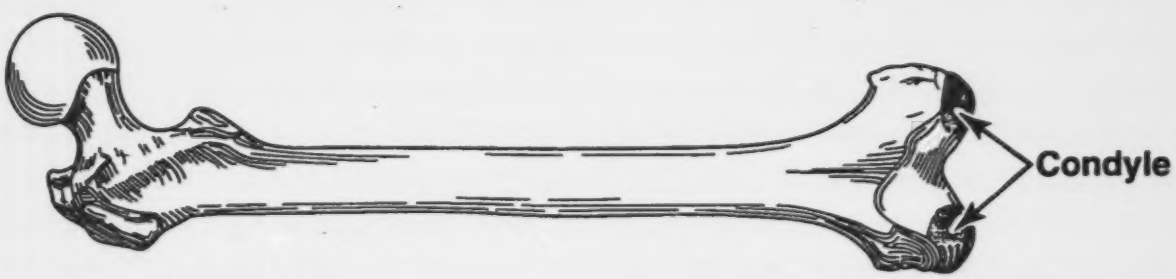
Cavities and Processes of Bones (cont.)



Tuberosity

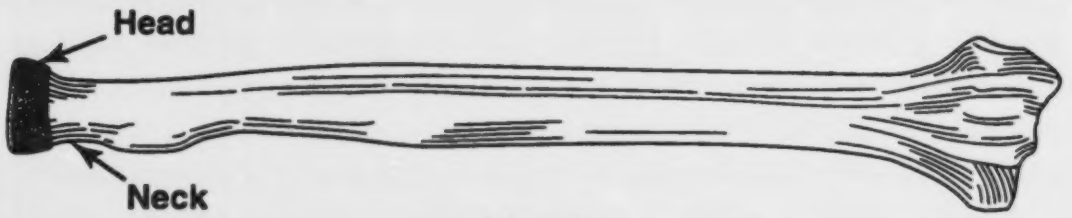


Tubercle



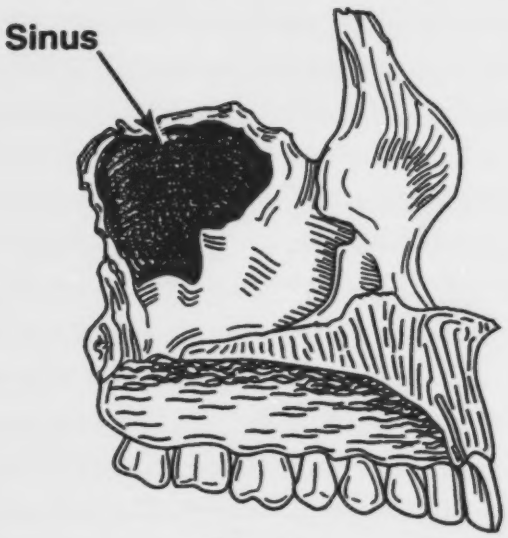
Condyle

Cavities and Processes of Bones (cont.)



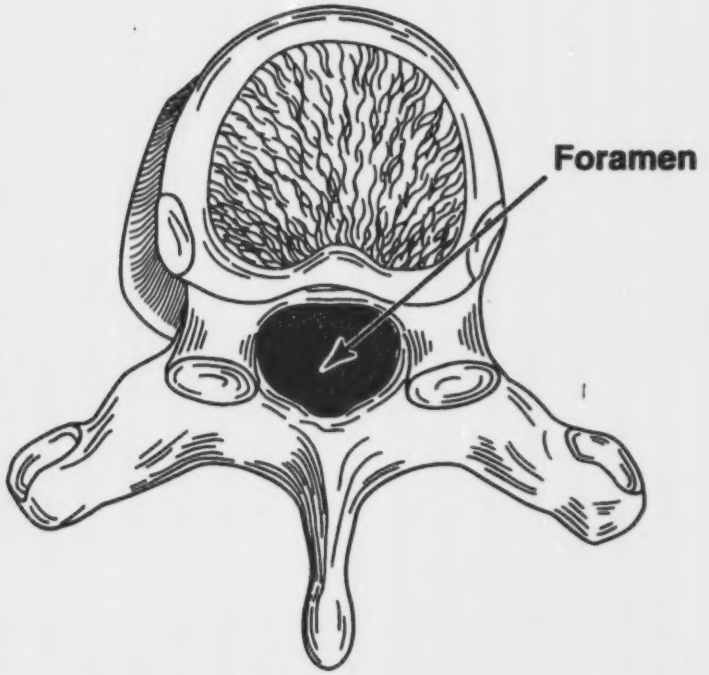
Head

Fossa

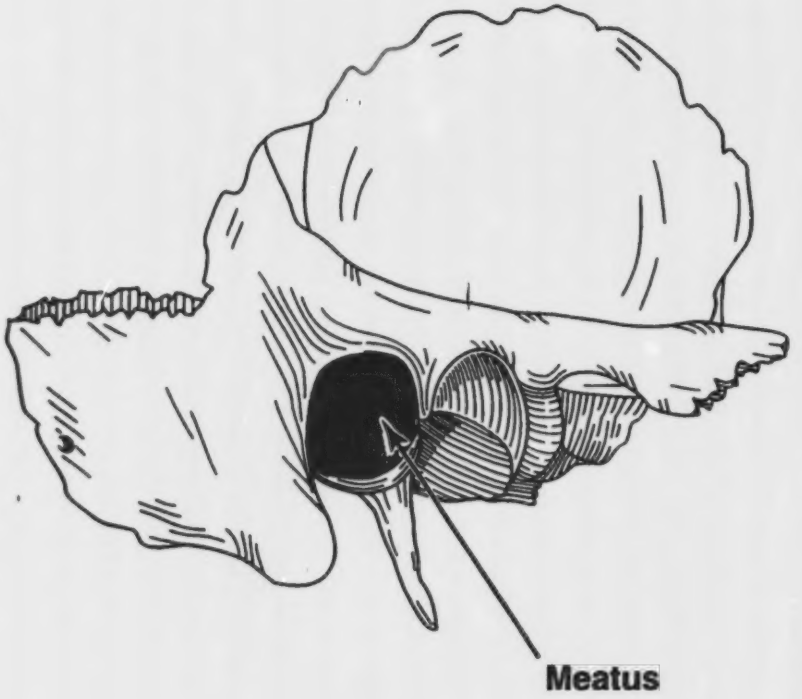


Sinus

Cavities and Processes of Bones (cont.)

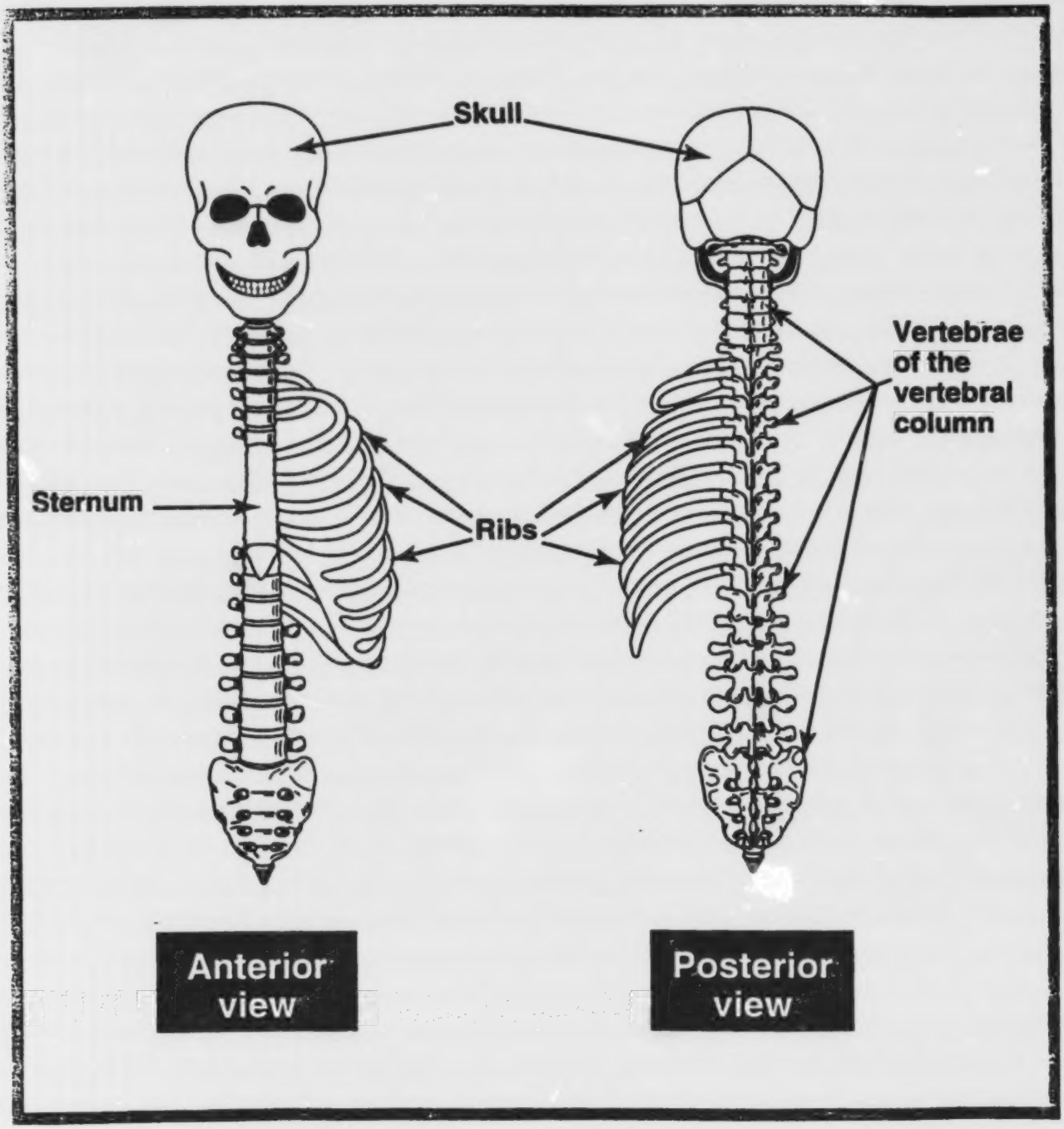


Foramen

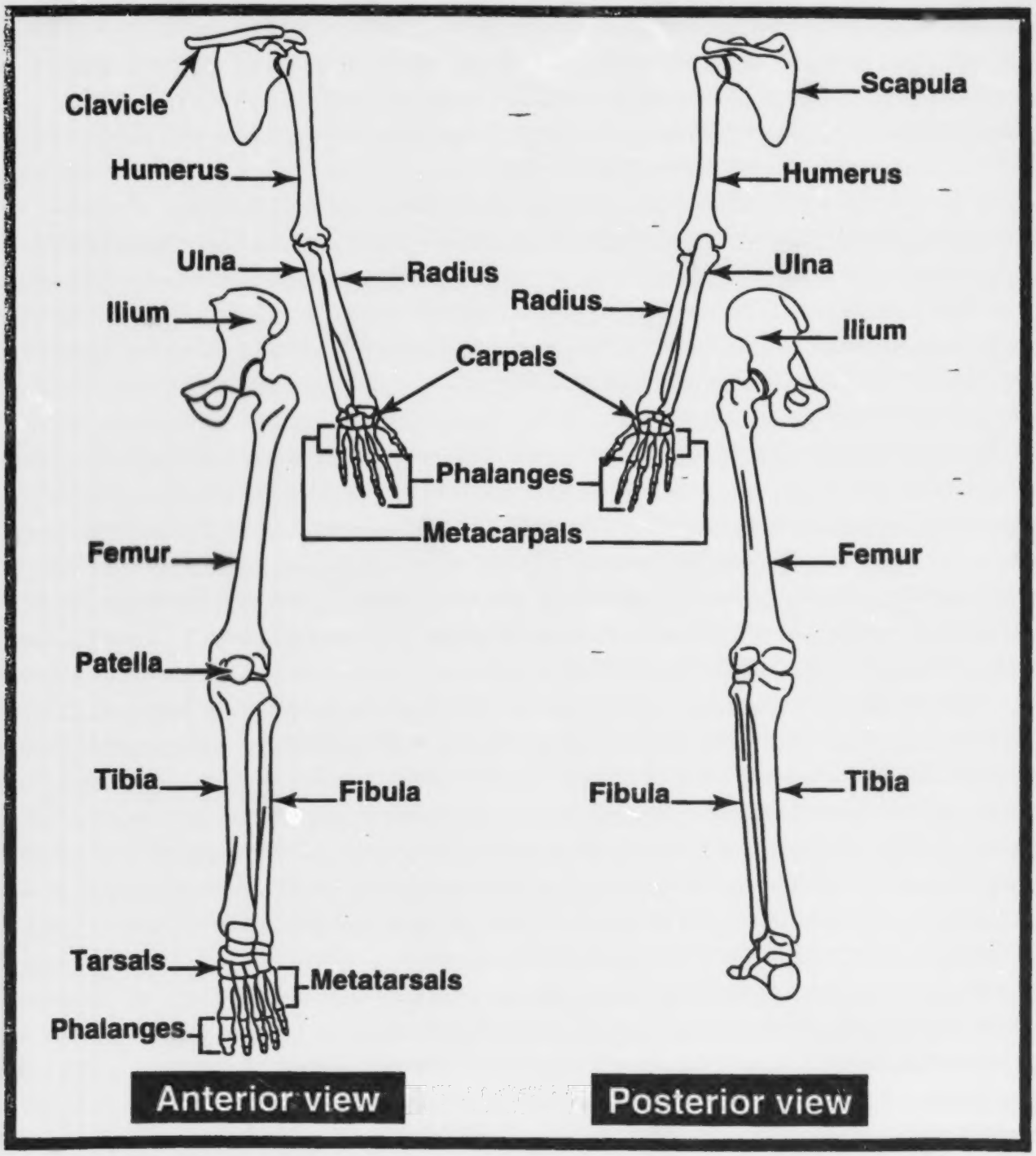


Meatus

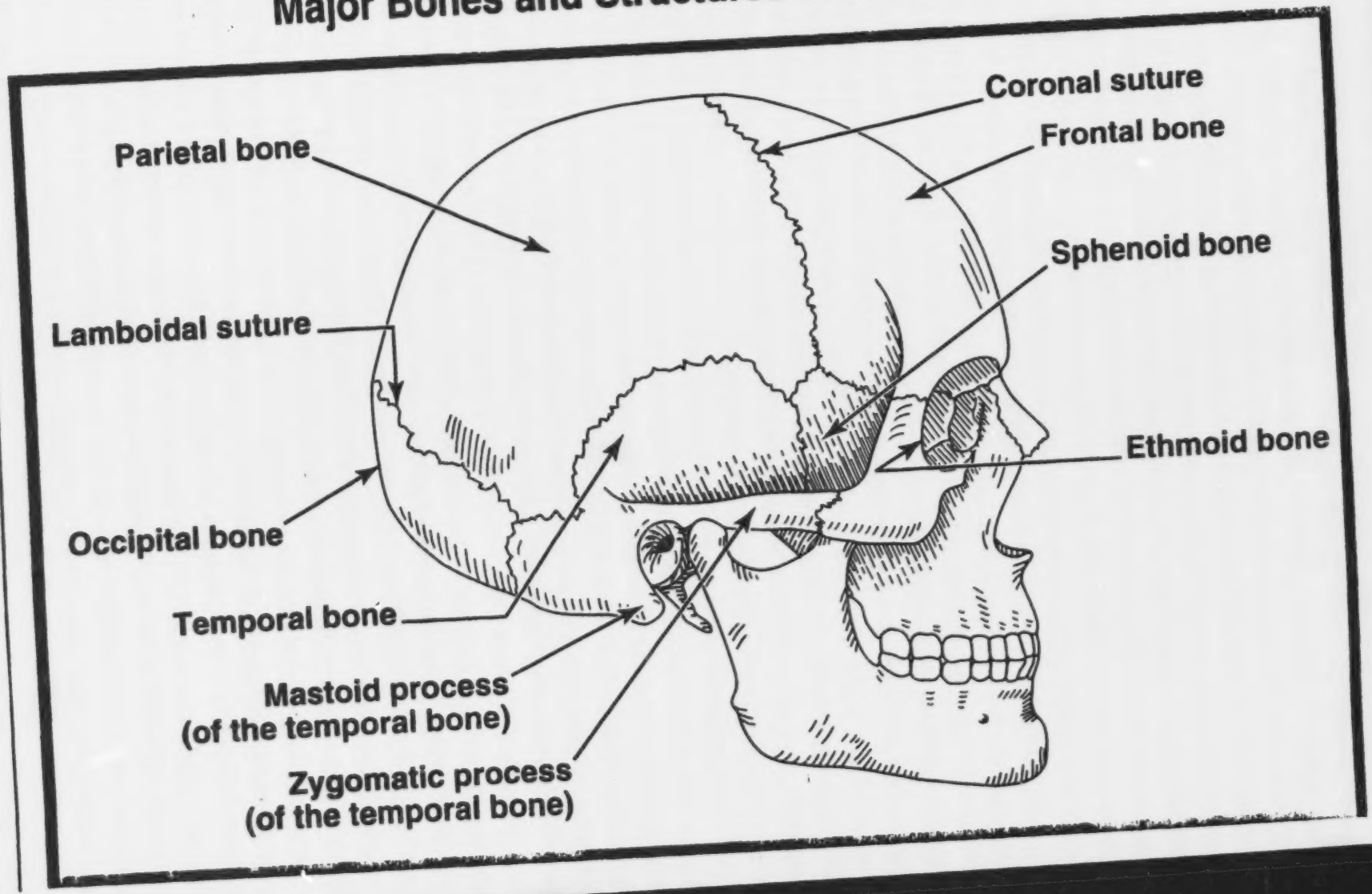
Major Components of the Anterior and Posterior Axial Skeleton



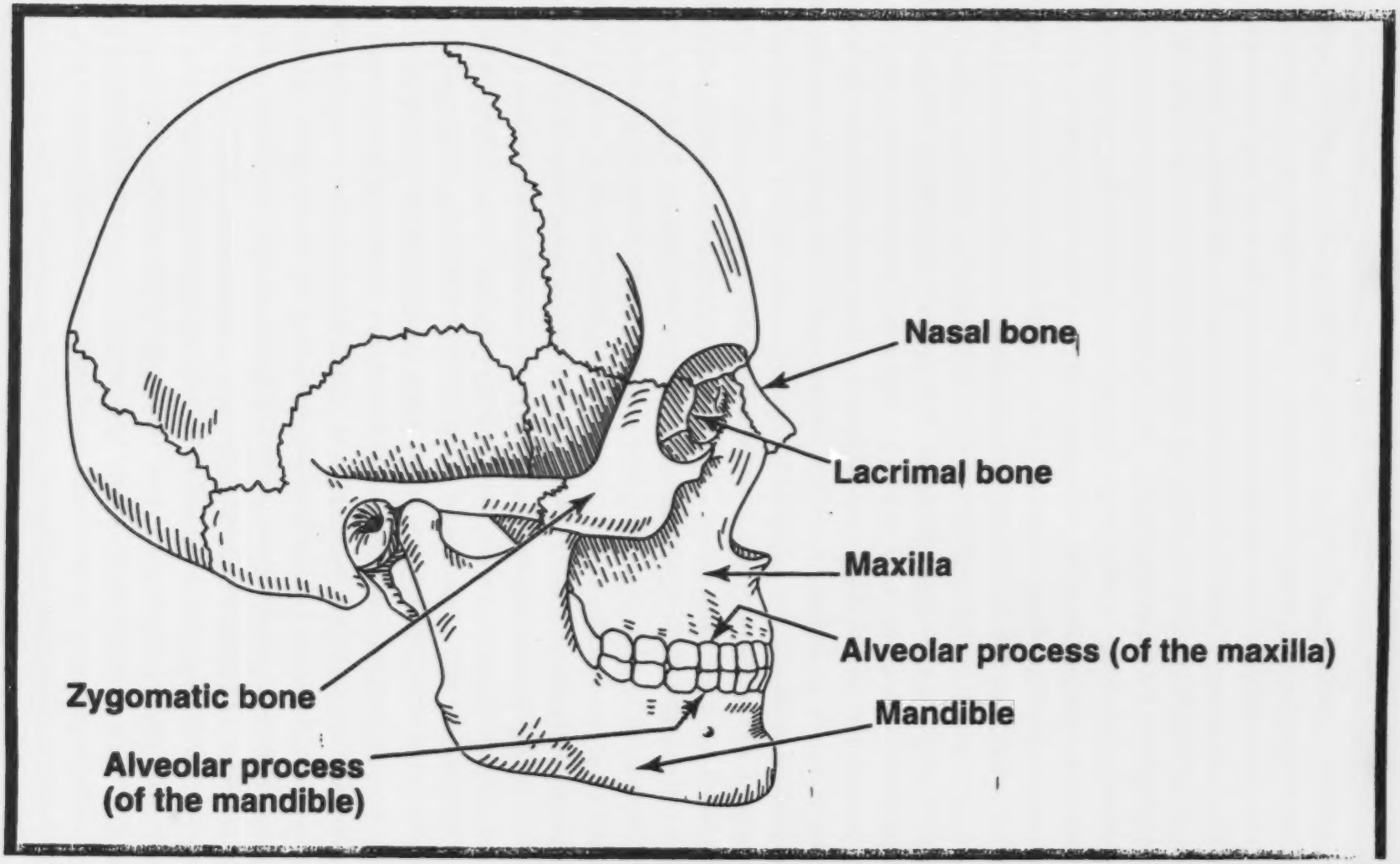
Major Bones of the Anterior and Posterior Appendicular Skeleton



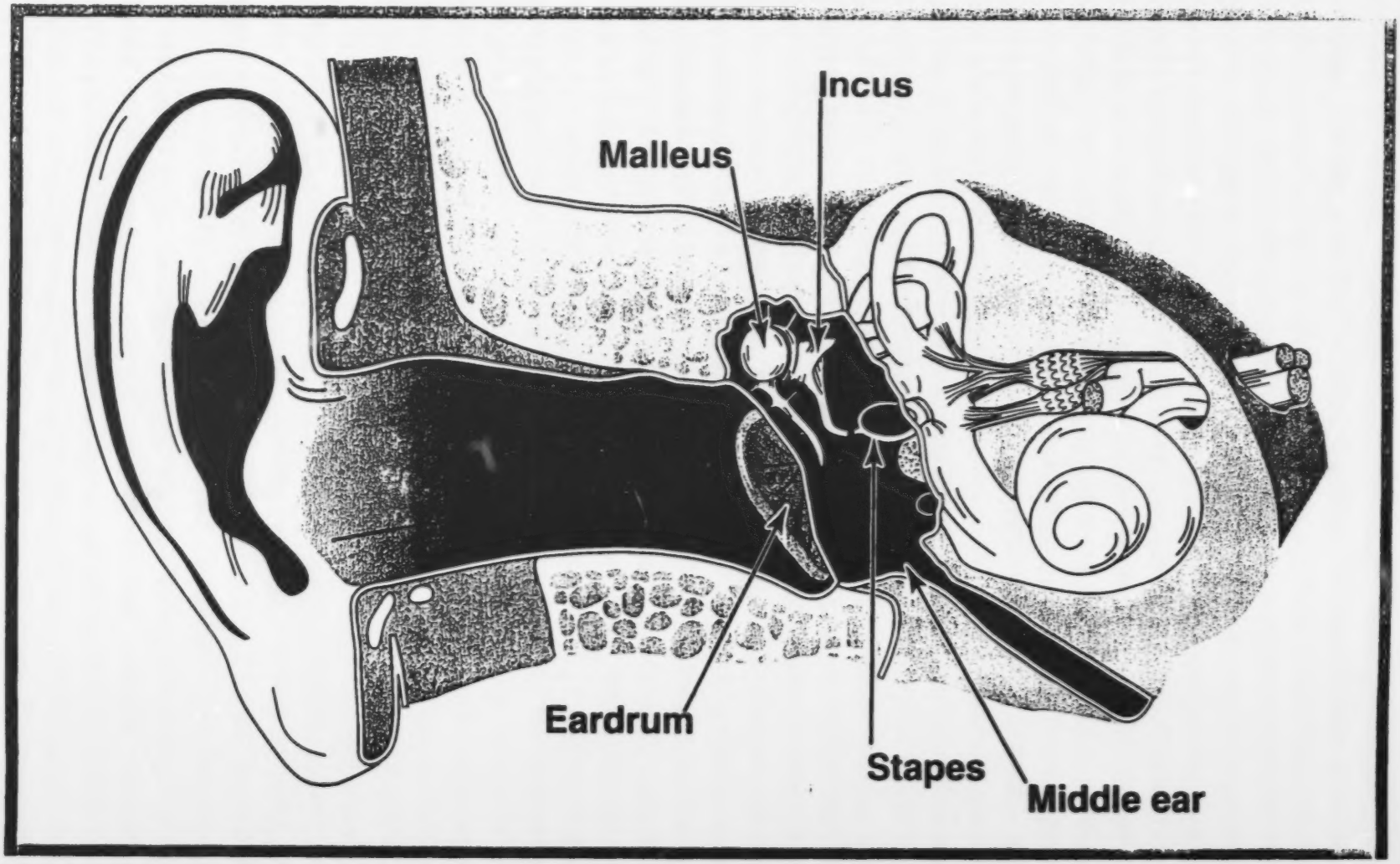
Major Bones and Structures of the Cranium



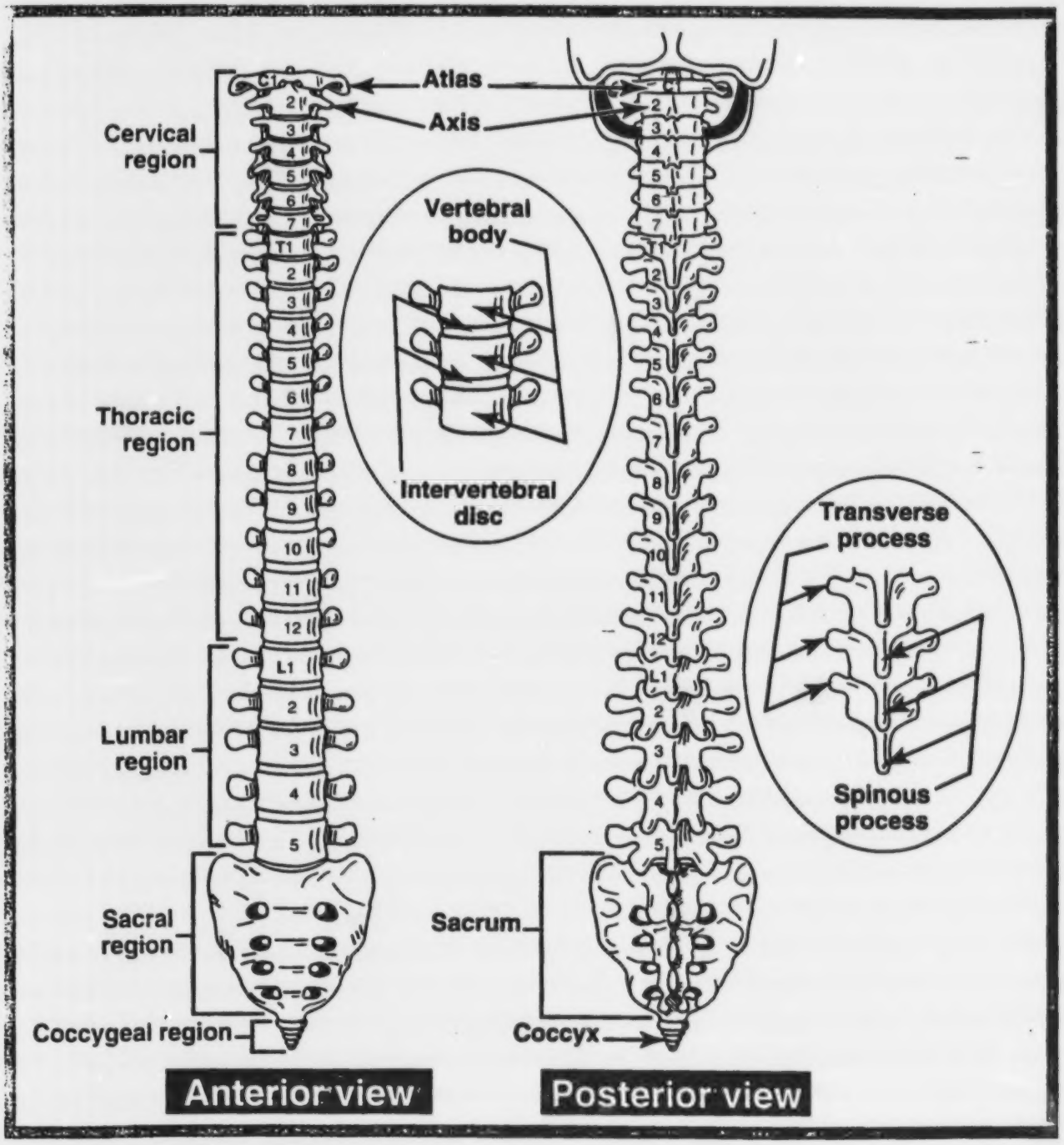
Major Bones and Structures of the Face



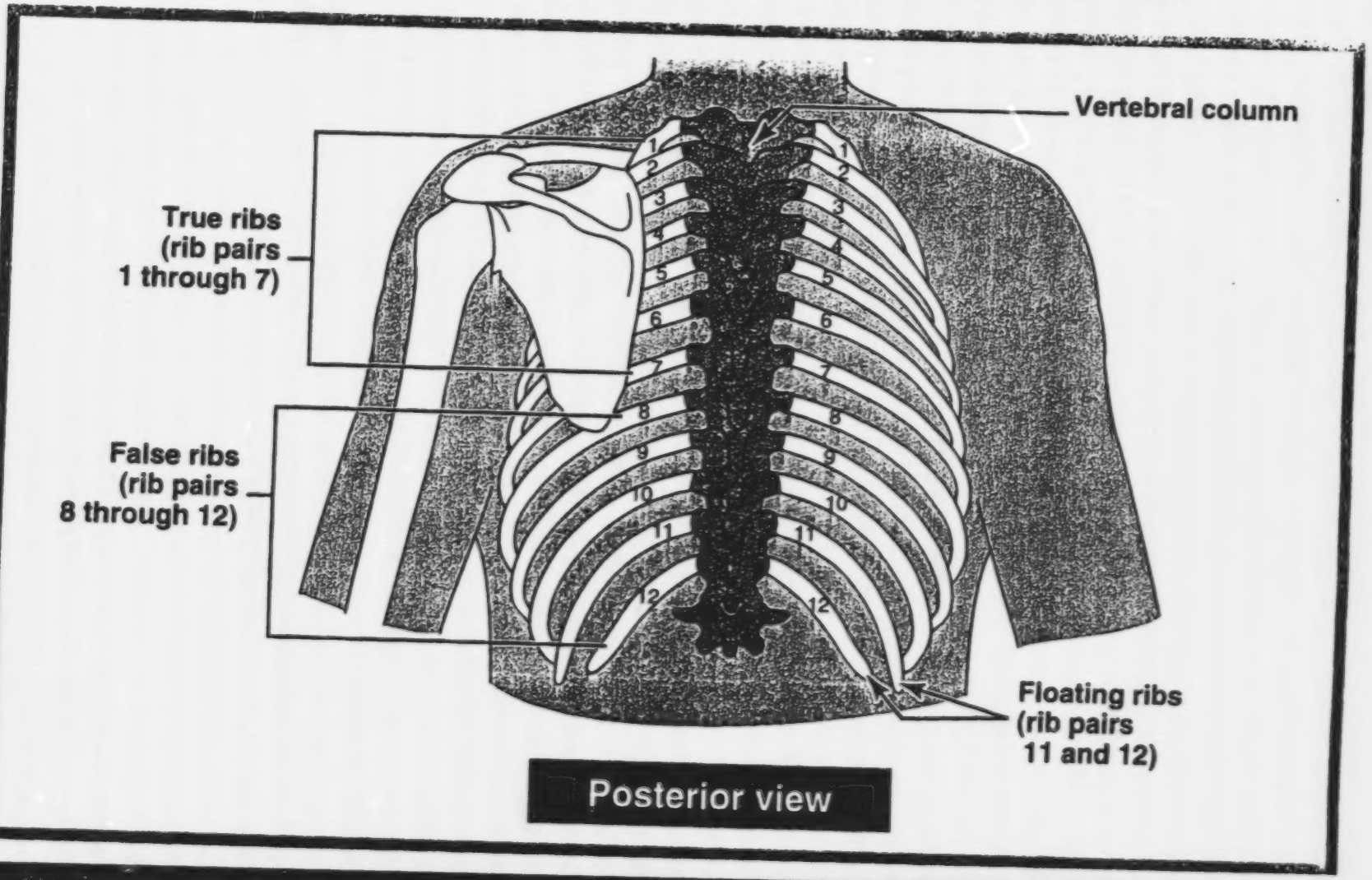
Major Bones of the Ear



Regions and Major Bones and Structures of the Vertebral Column

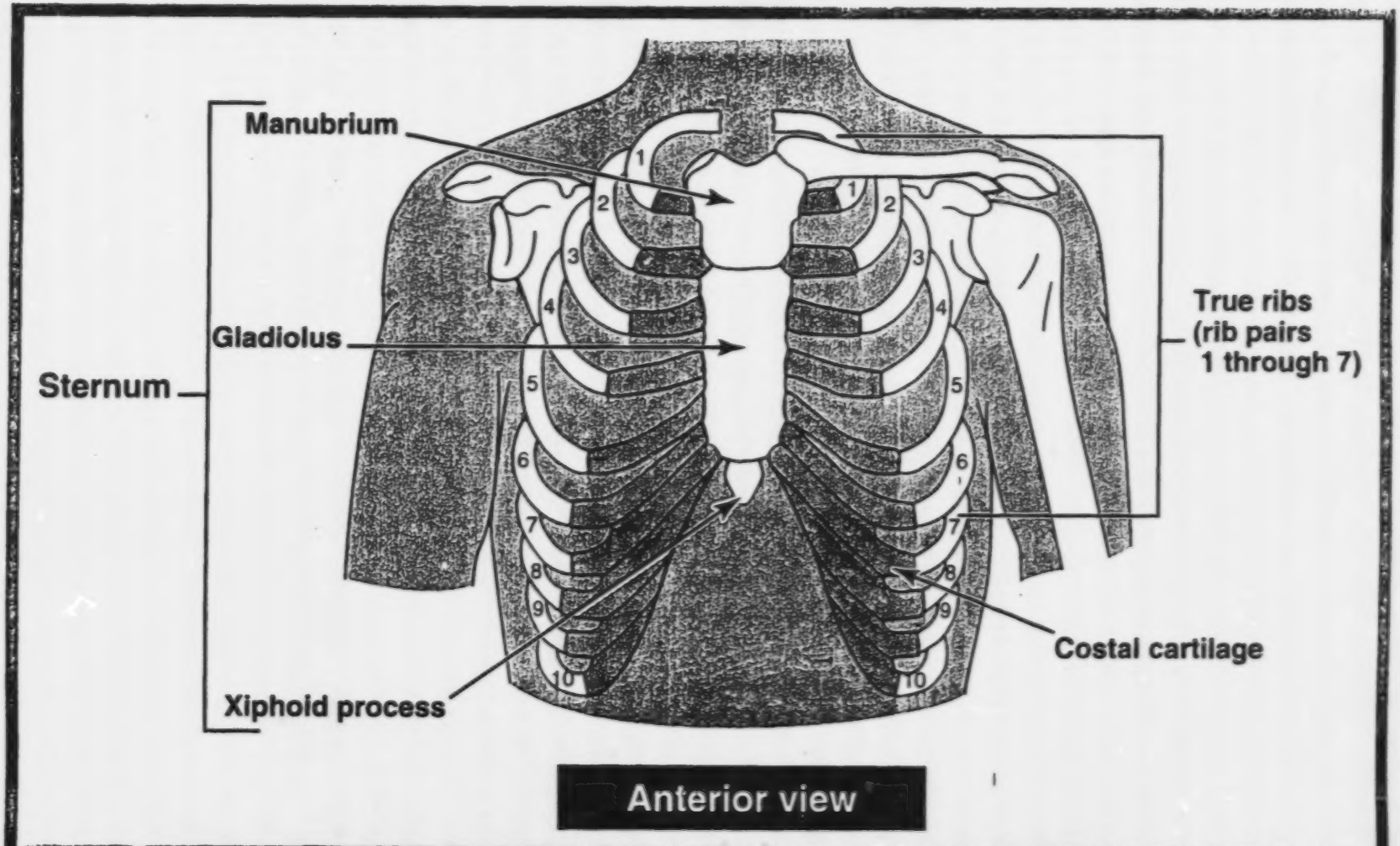


Major Bones and Structures of the Ribs and Sternum



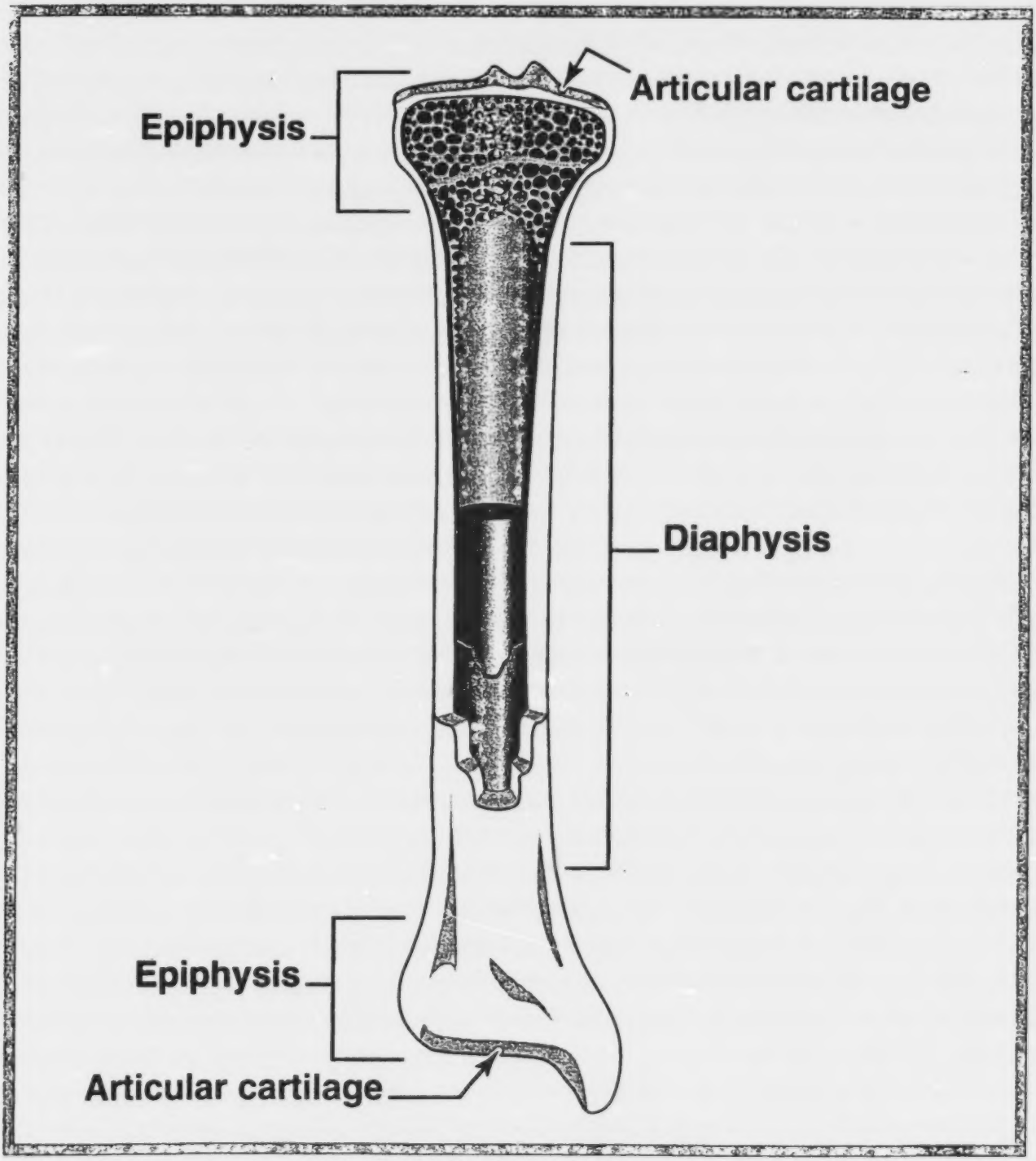
Posterior view

Major Bones and Structures of the Ribs and Sternum (cont.)



Anterior view

Articular Cartilage



Written Test

Name _____

Date _____ Score _____

OBJECTIVE 1 Define the term *skeletal system*. Write your answer on the blank lines provided beside the term below.

Skeletal system _____

_____

_____

OBJECTIVE 2 State the functions of the skeletal system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

OBJECTIVE 3 Distinguish between phrases that describe the characteristics of bone and cartilage. Write a "B" on the blank line before a phrase that describes bone and a "C" on the blank line before a phrase that describes cartilage.

_____ a. Is firm, yet flexible

_____ b. Is firm and hard in structure

_____ c. Consists of osteocytes

_____ d. Consists of chondrocytes

_____ e. Includes a matrix of protein

_____ f. Includes a matrix of calcium salts and collagen

_____ g. Has a system of haversian canals and canaliculi that ensures a good supply of blood and pathways for the movement of substances within the matrix

_____ h. Has no capillaries in the matrix so blood is supplied by diffusion

Objective 4 List the major components of bones. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

Objective 5 Complete statements that describe the types of bones as classified by their location and structure. Write your answers on the blank lines provided in the statements below.

a. Long bones are found in the _____, _____, _____, and _____.

b. Short bones include the _____ and _____.

c. Flat bones include the _____, _____, _____, and _____.

d. Irregular bones include the _____ and _____.

e. Sesamoids include the _____ and small bones in the _____ and _____.

f. Long bones contain _____ bone marrow in the shaft.

g. Short bones contain _____ bone marrow in the spongy bone.

h. Flat bones contain _____ bone marrow in the spongy bone.

i. Irregular bones contain _____ bone marrow in the spongy bone.

j. Long bones contain spongy bone covered with compact bone in the _____.

k. Long bones consist of a long shaft called a _____ and two rounded ends, each called an _____.

l. Short bones are made of spongy bone covered with _____ bone.

m. Flat bones are made of spongy bone covered with _____ bone.

n. Irregular bones are made of spongy bone covered with _____ bone.

o. Sesamoids often develop in new locations due to the use of _____.

p. Sesamoids consist of cartilage that _____ with age.

Objective 6 State the characteristics of bone marrow. Write your answers on the blank lines provided below.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

Objective 7 Define the major structures of a long bone. Write your answers on the blank lines provided beside each of the terms below.

a. Epiphysis _____

_____

b. Cancellous bone _____

_____

c. Compact bone _____

_____

d. Medullary cavity _____

_____

e. Periosteum _____

_____

f. Epiphyseal cartilage _____

_____

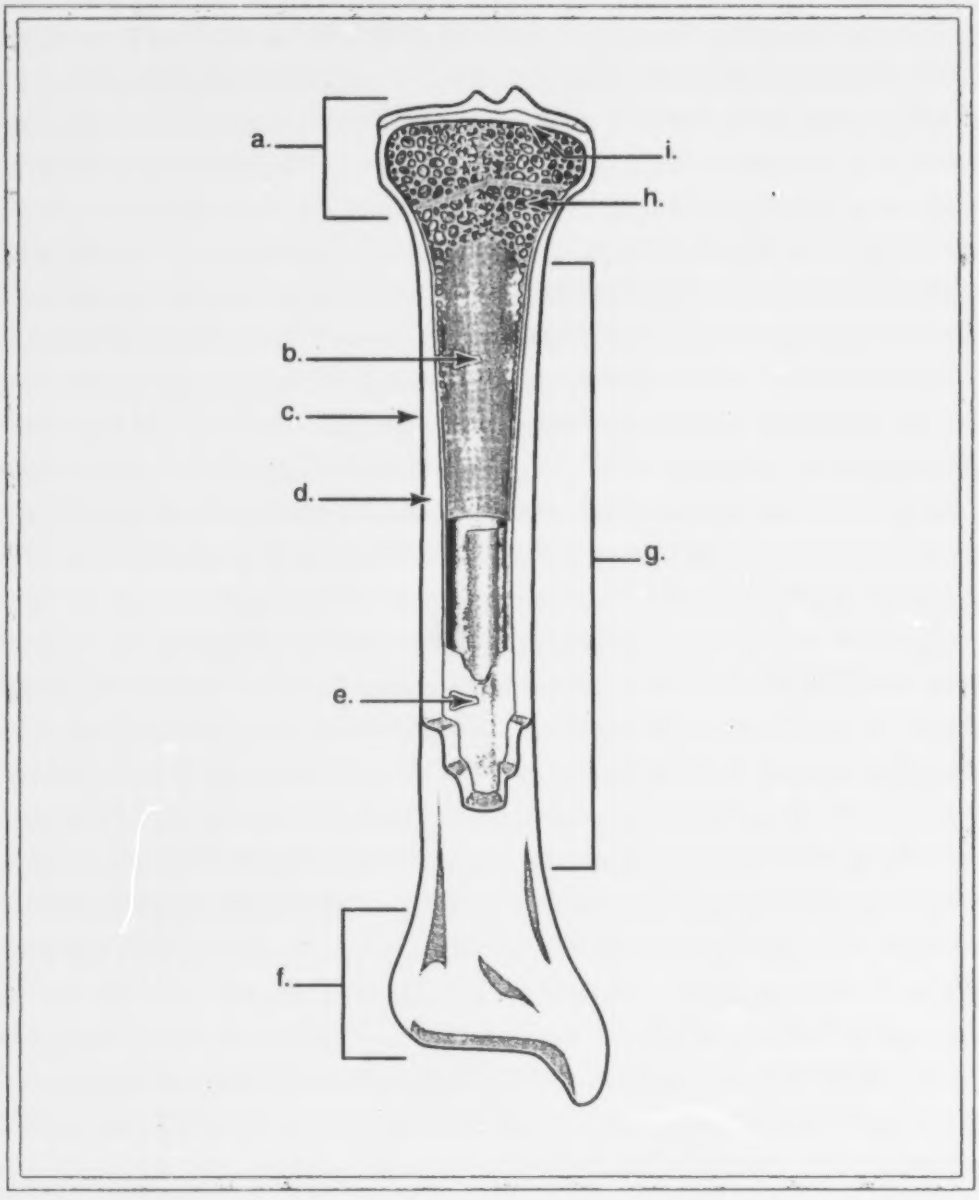
g. Diaphysis _____

_____

h. Endosteum _____

_____

Objective 8 Label the major structures of a long bone. Write your answers on the blank lines provided below the following illustration.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____

Objective 9

Match the long bones of the skeleton to their correct definitions. Write the numbers on the blanks provided.

_____ a. The long bones that form the framework of the sole of the foot

_____ b. The long bone on the little-finger side of the forearm

_____ c. The long, slender bone on the lateral side of the lower leg

_____ d. The miniature long bones of the fingers and the miniature long bones of the toes

_____ e. The long bone on the thumb side of the forearm

_____ f. The shin bone; the largest bone in the lower leg

_____ g. The thighbone; the longest, strongest bone in the body

_____ h. The long bone in the upper arm

_____ i. The long bones forming the framework of the palm of the hand

1. Femur
2. Fibula
3. Humerus
4. Metacarpals
5. Metatarsals
6. Phalanges
7. Radius
8. Tibia
9. Ulna

Objective 10

Define terms that describe the cavities and processes of bones. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Trochanter _____

_____

b. Crest _____

_____

c. Spinous process _____

_____

d. Tuberosity _____

_____

e. Tubercle _____

_____

f. Condyle _____

_____

g. Head _____

h. Fossa _____

i. Sinus _____

j. Foramen _____

k. Meatus _____

OBJECTIVE 11

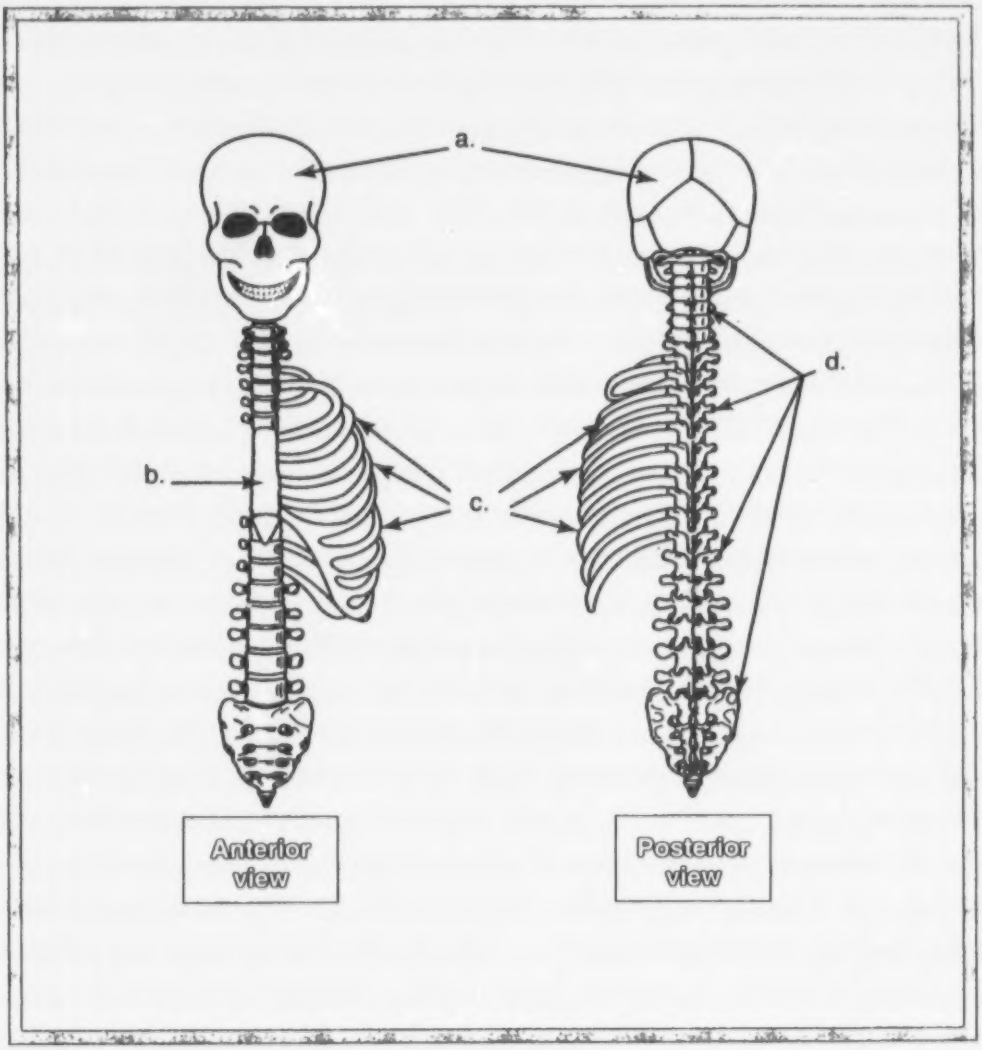
Describe the major divisions of the human skeleton. Write your answers on the blank lines provided beside each of the terms below.

a. Axial skeleton _____

b. Appendicular skeleton _____

Objective 12

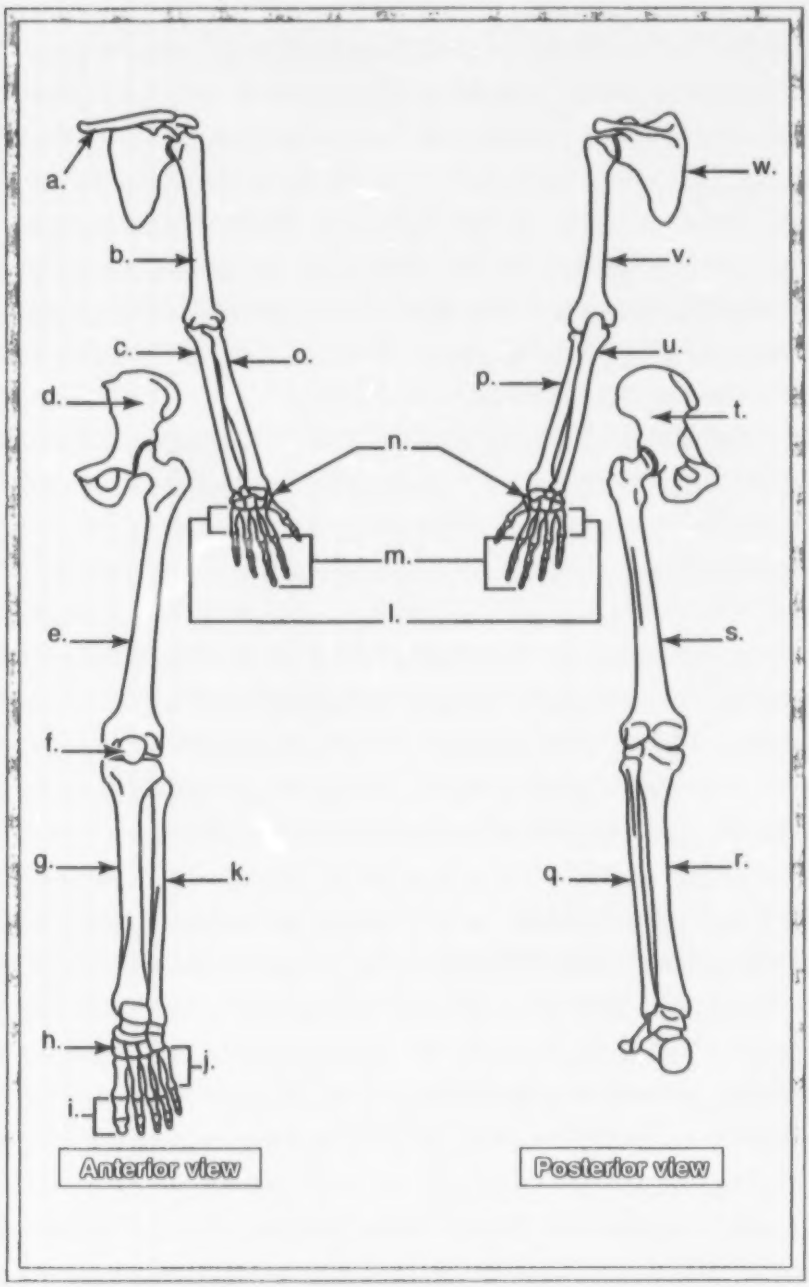
Label the major components of the anterior and posterior axial skeleton. Write your answers on the blank lines provided under the following illustration.



a. _____ c. _____

b. _____ d. _____

Objective 13 Label the major bones of the anterior and posterior appendicular skeleton. Write your answers on the blank lines provided beside the following illustration.



a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____
h. _____
i. _____
j. _____
k. _____
l. _____
m. _____
n. _____
o. _____
p. _____
q. _____
r. _____
s. _____
t. _____
u. _____
v. _____
w. _____

OBJECTIVE 14

Define the major bones and structures of the cranium, face, and ear. Write your answers on the blank lines provided beside each of the terms below and on the next page.

Major bones and structures of the cranium

a. Parietal bone _____

b. Temporal bone _____

c. Frontal bone _____

d. Occipital bone _____

e. Sphenoid bone _____

f. Ethmoid bone _____

g. Coronal suture _____

h. Lambdoidal suture _____

i. Zygomatic process _____

j. Mastoid process _____

Major bones and structures of the face

a. Maxilla _____

b. Nasal bone _____

c. Lacrimal bone _____

_____

d. Mandible _____

_____

e. Alveolar process _____

_____

f. Zygomatic bone _____

Major bones of the ear

a. Malleus _____

_____

b. Incus _____

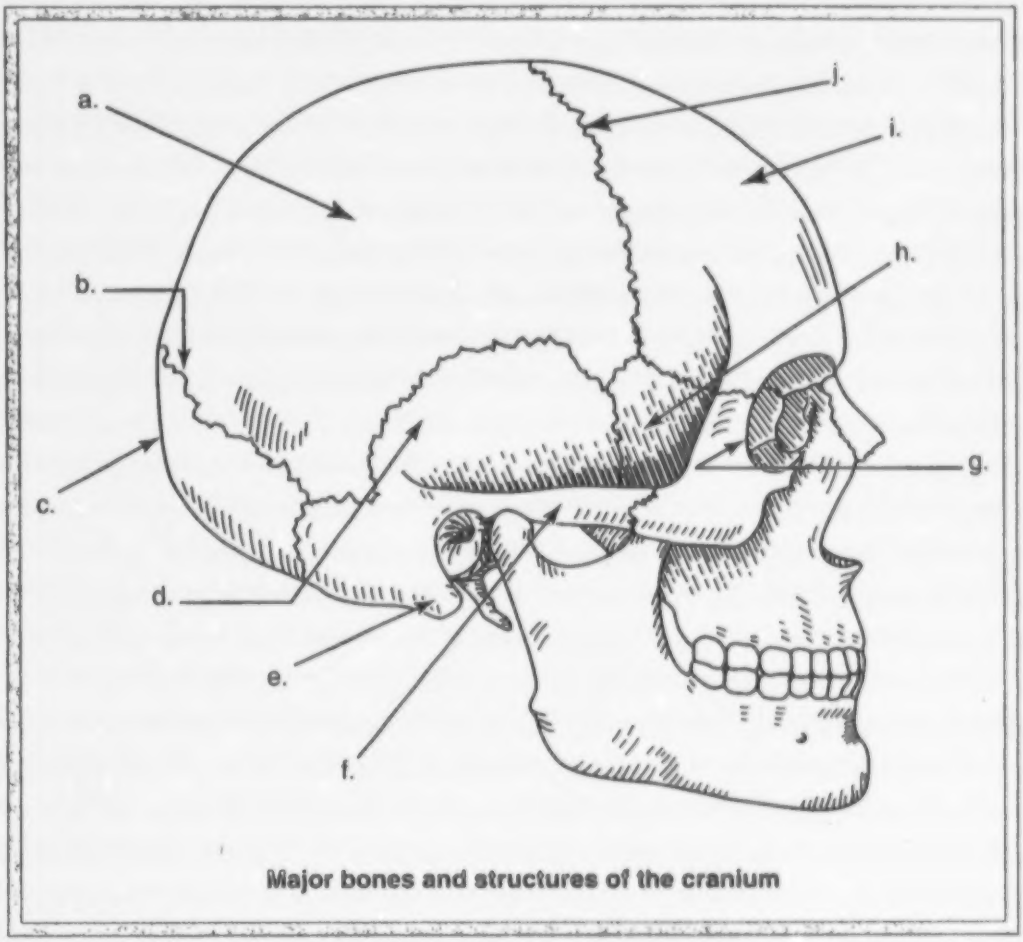
_____

c. Stapes _____

_____

OBJECTIVE 15

Label the major bones and structures of the cranium, face, and ear. Write your answers on the blank lines provided under each of the following illustrations.



Major bones and structures of the cranium

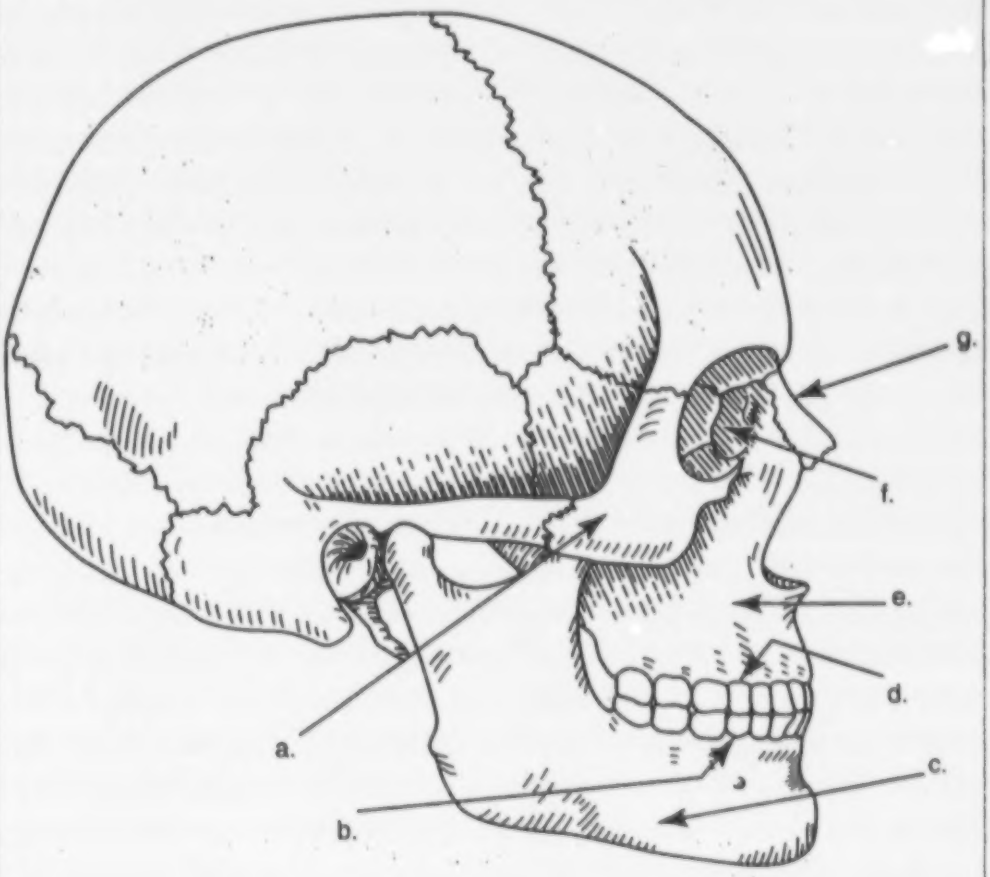
a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____ j. _____



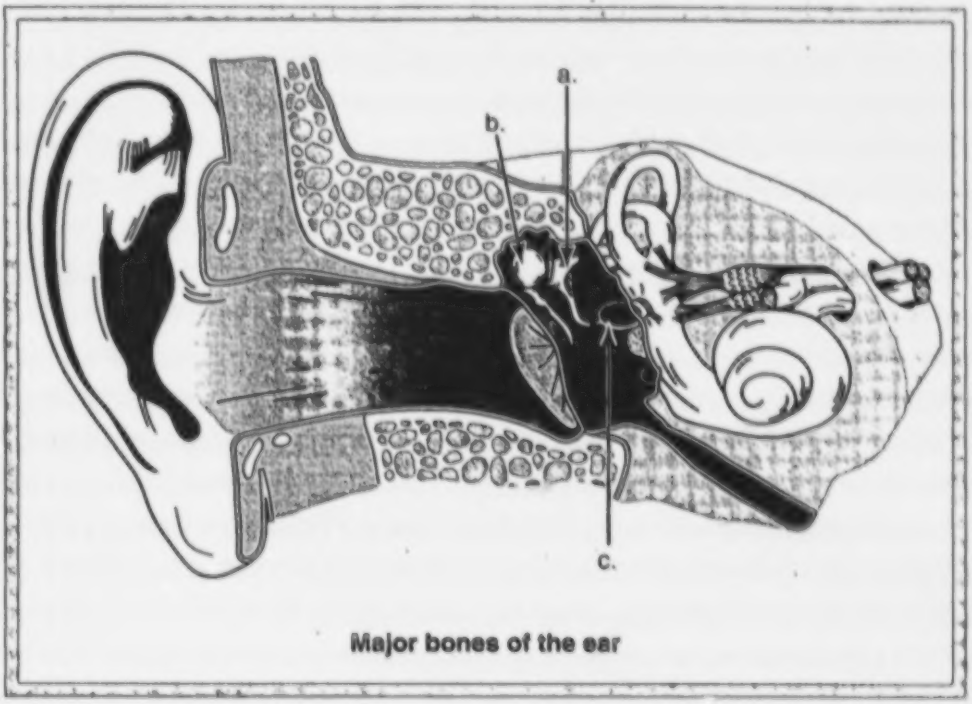
Major bones and structures of the face

a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____



Major bones of the ear

a. _____ c. _____

b. _____

OBJECTIVE 16 State the characteristics of the hyoid bone. Write your answers on the blank lines provided below.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

e. _____

_____

OBJECTIVE 17

Define the regions and the major bones and structures of the vertebral column. Write your answers on the blank lines provided beside each of the terms below and on the next page.

Regions of the vertebral column

a. Cervical region _____

b. Thoracic region _____

c. Lumbar region _____

d. Sacral region _____

e. Coccygeal region _____

Major bones and structures of the vertebral column

a. Atlas _____

b. Axis _____

c. Vertebral body _____

d. Transverse process _____

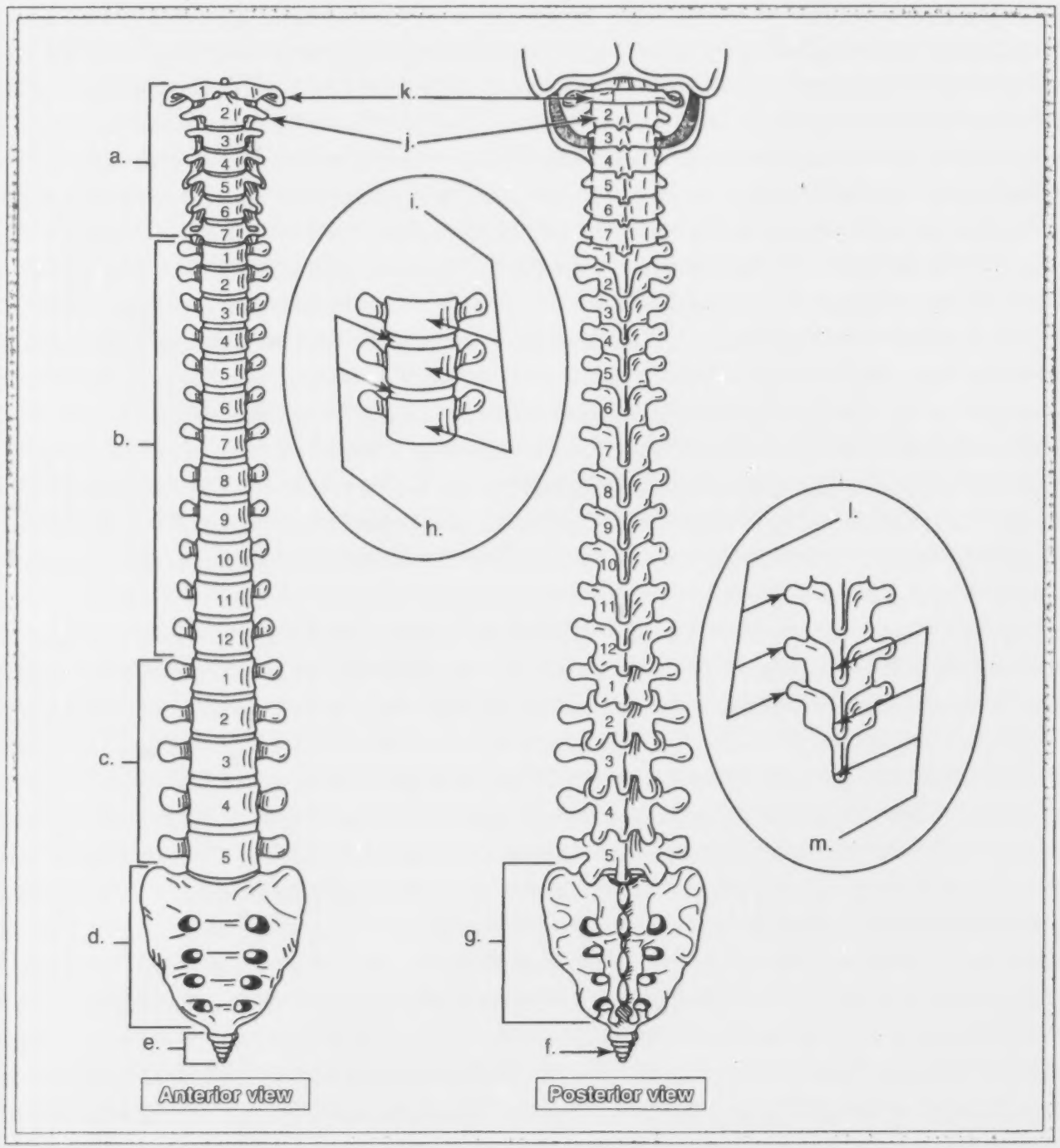
e. Spinous process _____

f. Intervertebral disc _____

g. Sacrum _____

h. Coccyx _____

Objective 18 Label the regions and the major bones and structures of the vertebral column. Write your answers on the blank lines provided on the next page.



a. _____ h. _____

b. _____ i. _____

c. _____ j. _____

d. _____ k. _____

e. _____ l. _____

f. _____ m. _____

g. _____

OBJECTIVE 19

Complete statements that describe the characteristics of the ribs and sternum. Write your answers on the blank lines provided in the statements below.

Ribs

a. All ribs attach to the _____ region of the vertebral column.

b. There are _____ rib pairs.

c. The upper 7 rib pairs attach directly to the sternum; these are known as the _____ *ribs.*

d. The lower 5 rib pairs (rib pairs 8 through 12) are referred to as the _____ *ribs.*

e. Rib pairs 11 and 12 are not attached to the sternum and are called the _____ *ribs.*

f. Rib pairs 8, 9, and 10 attach to the costal cartilage of the _____ rib.

Sternum

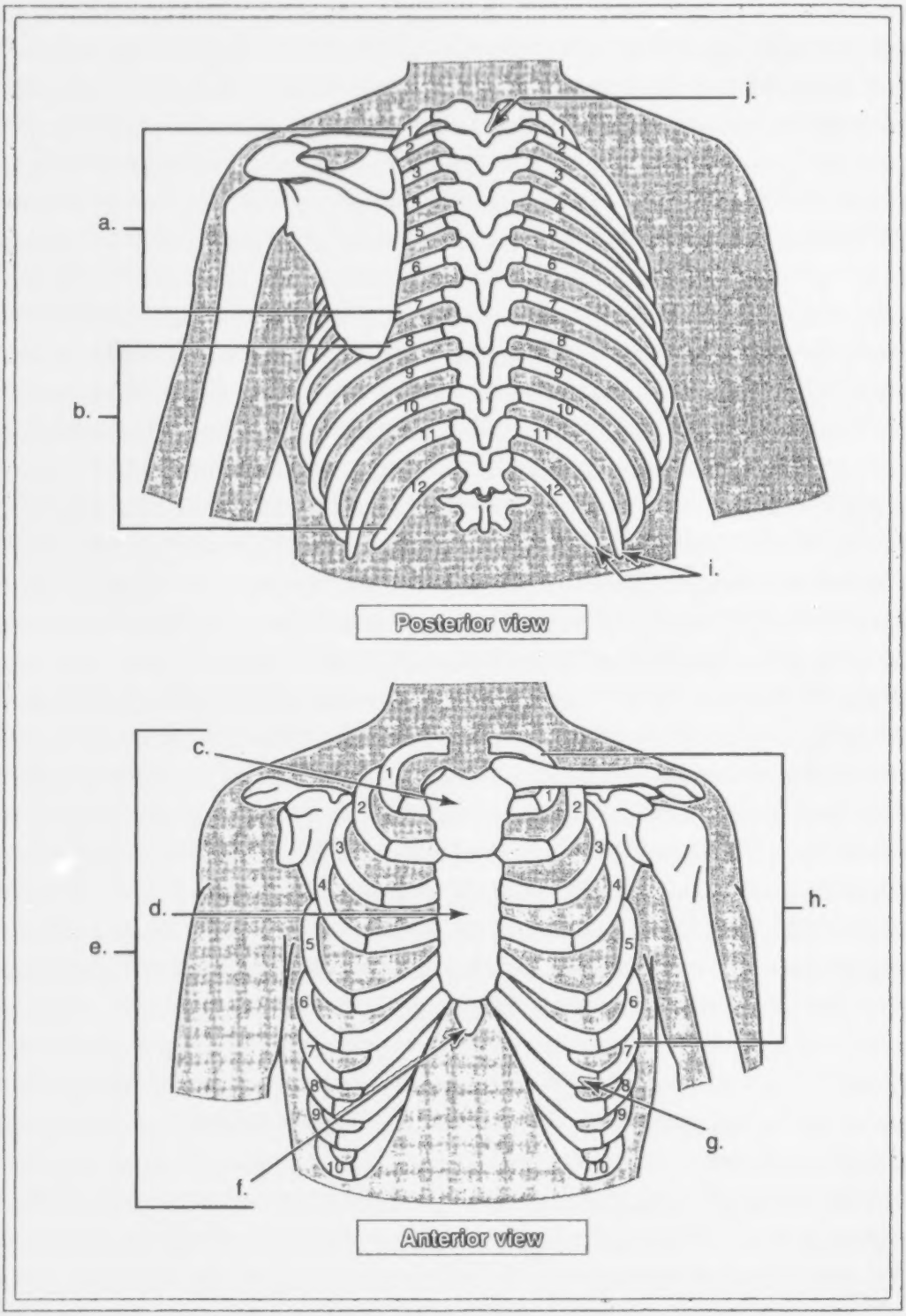
a. The top section of the sternum is called the _____, and it provides the attachment for rib pair 1.

b. The middle (body) section of the sternum is called the _____, and it provides the attachment for rib pairs 2 through 7.

c. The lowest section of the sternum is called the _____ *process.*

OBJECTIVE 20

Label the major bones and structures of the ribs and sternum. Write your answers on the blank lines provided on the next page.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____ j. _____

Objective 21 Define the term *articular system*. Write your answer on the blank lines provided beside the term below.

Articular system _____

_____

_____

Objective 22 State the functions of the articular system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

Objective 23 Complete statements that describe the major structures and substances of the articular system. Write your answers on the blank lines provided in the statements below and on the next page.

Ligaments

a. Ligaments are connective tissue bands that hold _____ together.

b. Ligaments are found in connection with all the _____ joints and in many of the _____ joints.

c. Ligaments help to _____ and _____ the joints.

Articular cartilages

a. Articular cartilages are smooth layers of cartilage that cover the ends of opposing _____.

b. Articular cartilages are found where bones meet adjacent _____.

c. Articular cartilages provide a smooth _____ surface for opposing bones.

Synovial fluid

a. Synovial fluid is a _____, _____ fluid that resembles the white of a raw egg.

b. Synovial fluid is secreted by the _____ membrane, which is a thick, vascular connective tissue lining the inner surface of a joint capsule.

c. Synovial fluid acts as a _____.

d. Synovial fluid provides a lubricated _____ surface for the adjacent bone.

e. Synovial fluid provides the major source of _____ for the articular cartilage.

OBJECTIVE 24

Distinguish among phrases that describe the types of articulations. Put an "S" before each phrase that describes a synarthrosis articulation, an "A" before each phrase that describes an amphiathrosis articulation, and a "D" before each phrase that describes a diathrosis articulation.

_____ a. Are immovable

_____ b. Are slightly movable

_____ c. Are freely movable

_____ d. Include two types: symphysis and synchrondrosis

_____ e. Include six types: ball-and-joint socket, hinge joint, pivot joint, condyloid joint, saddle joint, and gliding joint

_____ f. Have a joint cavity enclosed by an articular cavity

_____ g. Do not have a joint cavity

_____ h. Have ligaments that cover and connect the ends of the opposing bones

_____ i. Have synovial fluid

_____ j. Include sutures in the skull, facial bones, and the distal tibiofibular joint

_____ k. Include the hip and femur joint, knee, wrist, elbow, and shoulder joints

_____ l. Consist of fibrous cartilage or bone tissue that grows between the articulating surfaces

Objective 25

Describe types of amphiathrosis articulations. Write your answers on the blanks provided beside each of the terms below.

a. Symphysis joint _____

_____

_____

b. Synchrondrosis joint _____

_____

_____

Objective 26

Match types of diathrosis articulations to their correct descriptions. Write the correct numbers on the blanks below. Numbers will be used more than once.

1. Ball-and-joint socket
2. Hinge joint
3. Pivot joint
4. Condyloid joint
5. Saddle joint
6. Gliding joint

_____ a. Includes the hip and femur joint and the humerus and scapula joint

_____ b. Includes the joint between the carpals and the thumb metacarpals

_____ c. Includes the joints between the carpals and between the tarsals

_____ d. Includes the wrist joint between the radius and the carpal bones

_____ e. Includes rotation of the head and the joint between the radius and ulna

_____ f. Motion is possible in two planes at right angles to each other

_____ g. Does not permit axial motion

_____ h. Provides movement in two directions

_____ i. Motion is limited to uniaxial rotation

_____ j. Motion is limited to flexion and extension in a single plane

_____ k. Provides angular movement in one direction

_____ l. Provides the widest range of motion with movement in all planes in addition to rotation

_____ m. Has an oval-shaped process that fits into an elliptical cavity

_____ n. Has a ball-shaped head that fits into a concave cavity

_____ o. Includes the knee, elbow, and finger joints

_____ p. Has a convex surface that fits into a concave cavity

_____ q. Has flat articular surfaces or matching slightly concave and slightly convex surfaces

_____ r. Has a process that rotates around a bony fossa around a longitudinal axis

_____ s. Has articular surfaces with each bone concave in one direction and convex in the other

OBJECTIVE 27

Match common disorders and abnormalities of the skeletal system to their correct definitions. Write the numbers on the blanks provided.

_____ a. A deficiency of vitamin D that can often lead to poor or abnormal bone growth in children

_____ b. A condition in which bone matrix is lost and not replaced, resulting in weakened bones and possible curvature of the spine

_____ c. A neoplasm of the bone that usually exhibits itself as a spur on a long bone and that generally remains benign

_____ d. Exaggerated curvature of the spinal column in the thoracic region

_____ e. A neoplasm of the hyaline cartilage that is usually malignant

_____ f. A condition of older adults in which there is a rapid and disorganized increase in osteoclasts

_____ g. An inflamed condition of a bone caused by infection with a pathogen

_____ h. An inflammation of the air spaces in the mastoid region of the temporal bone

_____ i. A condition in which the outer layer of the fibrous cartilage between vertebrae ruptures, resulting in stiffness, severe pain, and interference with nerve functioning

_____ j. An inflammation of the sac of synovial fluid that is found between some tendons and bones

_____ k. Side-to-side curvature of the spinal column

_____ l. A neoplasm of the bone that is usually malignant and metastatic

_____ m. A bone disease characterized by poor mineralization of the bone

_____ n. Exaggerated curvature of the spinal column in the lumbar region

_____ o. A congenital condition in which the bones that separate the oral and nasal cavities do not fuse

_____ p. A disease that leads to inflammation of the joints, resulting in stiff, painful joints

1. Arthritis
2. Bursitis
3. Chondrosarcoma
4. Cleft palate
5. Herniated disc
6. Kyphosis
7. Lordosis
8. Mastoiditis
9. Osteochondroma
10. Osteomalacia
11. Osteomyelitis
12. Osteoporosis
13. Osteosarcoma
14. Paget's disease
15. Ricketts
16. Scoliosis

Answers to Written Test

Objective 1

All of the bones and cartilage of the body that collectively provide the supporting framework for the muscles and organs

Objective 2

Answers may appear in any order.

a. Provides support for the body
b. Gives shape to the body
c. Protects delicate vital organs
d. Assists with body movements
e. Manufactures blood cells
f. Stores calcium and phosphorous

Objective 3

a. C	c. B	e. C	g. B
b. B	d. C	f. B	h. C

Objective 4

Answers may appear in any order.

a. Inorganic salts
b. Bone cells
c. Blood vessels
d. Nerves
e. Cartilage
f. Water

Objective 5

a. arms; legs; hands; feet
b. carpals; tarsals
c. ribs; scapulae; ilium; cranial bones
d. vertebrae; facial bones
e. patella; hands; feet
f. yellow
g. red
h. red
i. red
j. epiphyses
k. diaphysis; epiphysis
l. compact
m. compact
n. compact
o. tendons
p. ossifies

Objective 6

Answers may appear in any order.

a. Is a soft, sponge-like material found in the cavities of bones

b. Is a network of blood vessels and special connective tissue that holds together fat and blood-producing cells

c. Is red in the diploe, ribs, sternum, vertebral bones, and proximal epiphysis of the humeri and femurs

d. Is yellow in most other bones, consisting primarily of fatty tissues

Objective 7

a. The part or process of a bone that ossifies separately and later becomes ankylosed to the main part of the bone; one of the ends of a long bone

b. The porous bone tissue that is normally present in the interior of many bones where the spaces are usually filled with marrow

c. The hard, dense tissue that is usually found at the surface of a bone

d. The cavity that contains the bone marrow

e. The fibrous vascular membrane covering a bone, except at the extremities

f. A thin layer of cartilage between the epiphysis and the diaphysis

g. The shaft of a long bone

h. The layer of vascular connective tissue lining the medullary cavity of a bone

Objective 8

a. Epiphysis
b. Medullary cavity
c. Periosteum
d. Endosteum
e. Epiphyseal cartilage
f. Epiphysis
g. Diaphysis
h. Cancellous bone
i. Compact bone

Objective 9

a. 5	d. 6	g. 1
b. 9	e. 7	h. 3
c. 2	f. 8	i. 4

Objective 10

a. A very large process to which muscles attach
b. A ridge on a bone
c. A sharp projection on a bone
d. A large rounded projection on a bone
e. A small rounded projection on a bone
f. A rounded process that generally mates with another to form a joint
g. A process that forms a joint at the end of a narrowed structure called a *neck*
h. A depression or hollow area in a bone
i. A cavity in bone that is lined with mucous membrane
j. A hole in a bone
k. A tubular opening or passage in a bone

Objective 11

a. Centers around the vertebral column and includes the bones of the skull, the ribs and sternum, and the vertebral column; contains 80 bones

b. Consists of the bones of the appendages that are attached to the axial skeleton and includes the bones of the shoulders, pelvis, arms, and legs; contains 126 bones

Objective 12

a. Skull
b. Sternum
c. Ribs
d. Vertebrae of the vertebral column

Objective 13

a. Clavicle
b. Humerus
c. Ulna
d. Ilium
e. Femur
f. Patella
g. Tibia
h. Tarsals
i. Phalanges
j. Metatarsals
k. Fibula
l. Metacarpals
m. Phalanges
n. Carpals
o. Radius
p. Radius
q. Fibula
r. Tibia
s. Femur
t. Ilium
u. Ulna
v. Humerus
w. Scapula

OBJECTIVE 14

Major bones and structures of the cranium

a. Either of a pair of bones of the roof of the skull between the frontal bone and the occipital bone

b. Either of a pair of compound bones at the side of the skull that contains various cavities and recesses associated with the ear

c. A single bone that forms the front of the skull

d. The cuplike bone at the back of the skull that is marked by a large opening by which the skull articulates with the atlas

e. The winged compound bone of the base of the skull and anterior to the temporal bone

f. A light, spongy, cubical bone forming much of the walls of the nasal cavity and part of those of the orbits

g. The suture extending across the skull between the parietal and frontal bones

h. The serrated suture between the occipital bone and the parietal bones of the skull

i. The process of a temporal bone that extends toward a zygomatic bone

j. The process of a temporal bone that extends behind an ear

Major bones and structures of the face

a. One of a pair of large bones that form the upper jaw

b. The bone forming the nasal cavity

c. One of the smallest and most-fragile bones of the face, located at the anterior part of the medial wall of the orbit

d. The large bone that forms the lower jaw

e. The portion of the maxilla or the mandible that forms the dental arch

f. One of a pair of bones that forms the prominence of the cheek and part of the orbit; a cheekbone

Major bones of the ear

a. One of the three bones of the middle ear, resembling a hammer with a head, neck, and three processes

b. One of the three bones of the middle ear, resembling an anvil

c. One of the three bones of the middle ear, resembling a tiny stirrup

OBJECTIVE 15

Major bones and structures of the cranium

a. Parietal bone
b. Lamboidal suture
c. Occipital bone
d. Temporal bone
e. Mastoid process (of the temporal bone)
f. Zygomatic process (of the temporal bone)
g. Ethmoid bone
h. Sphenoid bone
i. Frontal bone
j. Coronal suture

Major bones and structures of the face

a. Zygomatic bone
b. Alveolar process (of the mandible)
c. Mandible
d. Alveolar process (of the maxilla)
e. Maxilla
f. Lacrimal bone
g. Nasal bone

Major bones of the ear

a. Incus
b. Malleus
c. Stapes

OBJECTIVE 16

Answers may appear in any order.

a. The hyoid bone is considered to be part of the axial skeleton.

b. The hyoid bone is a single, U-shaped bone in the neck between the mandible and the upper part of the larynx.

c. The hyoid bone is the only bone in the body that does not articulate with another bone.

d. The hyoid bone is suspended by ligaments on processes from the temporal bone in the cranium.

e. The hyoid bone provides an attachment for the tongue.

OBJECTIVE 17

Regions of the vertebral column

a. The region consisting of the first seven segments of the vertebral column, designated C1 to C7

b. The region consisting of 12 segments of the upper-back portion of the vertebral column, designated T1 to T12

c. The region consisting of the five largest segments of the movable part of the vertebral column, designated L1 to L5

d. The region consisting of five segments of the vertebral column that fuse in the adult to form the sacrum

e. The region consisting of four segments of the vertebral column that fuse to form the adult coccyx; the segments of this region are considered rudimentary vertebrae

Major bones and structures of the vertebral column

a. The first cervical vertebra that articulates with the occipital bone and the axis

b. The second cervical vertebra about which the atlas rotates, allowing the head to be turned, extended, and flexed

c. The weight-supporting, solid central portion of a vertebra

d. One of the bony projections extending at a right angle from a vertebral body

e. The bony projection extending posteriorly from a vertebral body

f. One of the fibrous discs found between adjacent vertebrae, except for the axis and the atlas

g. The large, triangular bone at the dorsal part of the pelvis, inserted like a wedge between the two hip bones

h. The beaklike bone joined to the sacrum by a disc of fibrocartilage at the base of the vertebral column

OBJECTIVE 18

a. Cervical region
b. Thoracic region
c. Lumbar region
d. Sacral region
e. Coccygeal region
f. Coccyx
g. Sacrum
h. Intervertebral disc
i. Vertebral body
j. Axis
k. Atlas
l. Transverse process
m. Spinous process

Objective 19

Ribs

a. thoracic
b. 12
c. *true*
d. *false*
e. *floating*
f. seventh

Sternum

a. *manubrium*
b. *gladiolus*
c. *xiphoid*

Objective 20

a. True ribs
b. False ribs
c. Manubrium
d. Gladiolus
e. Sternum
f. Xiphoid process
g. Costal cartilage
h. True ribs
i. Floating ribs
j. Vertebral column

Objective 21

The structures that create joints between bones that allow movement of the body parts

Objective 22

Answers may appear in any order.

a. Allows changes of position and body motion
b. Bears the weight of the body
c. Provides stability
d. Lubricates the joints
e. Nourishes the cartilaginous structures

Objective 23

Ligaments

a. bones
b. freely movable; less-movable
c. reinforce; stabilize

Articular cartilages

a. bones
b. bones
c. gliding

Synovial fluid

a. thick; colorless
b. synovial
c. shock absorber
d. articulating
e. nutrition

Objective 24

a. S	d. A	g. S	j. S
b. A	e. D	h. D	k. D
c. D	f. D	i. D	l. S

Objective 25

a. Consists of bones growing together at a midline and includes the pubis joint and the joints between the vertebrae

b. Is held together by cartilage and includes the joints between the ribs and sternum

Objective 26

a. 1	e. 3	i. 3	m. 4	q. 6
b. 5	f. 4	j. 2	n. 1	r. 3
c. 6	g. 6	k. 2	o. 2	s. 5
d. 4	h. 5	l. 1	p. 2	

Objective 27

a. 15	e. 3	i. 5	m. 10
b. 12	f. 14	j. 2	n. 7
c. 9	g. 11	k. 16	o. 4
d. 6	h. 8	l. 13	p. 1

Answers to Assignment Sheets

Assignment Sheet 1

PROBLEM 1

a. Compound
b. Complete
c. Transverse

PROBLEM 2

a. Comminuted
b. Complete
c. All

PROBLEM 3

a. Simple
b. Incomplete
c. Linear

PROBLEM 4

a. Impacted
b. Complete
c. Oblique

PROBLEM 5

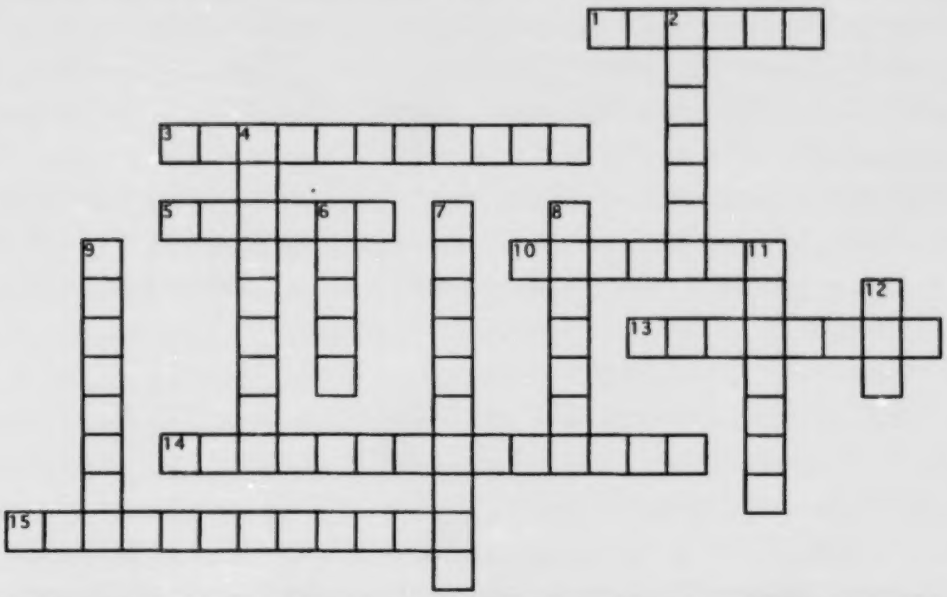
a. Simple
b. Complete
c. Oblique

Assignment Sheet 2

Evaluated to the instructor's satisfaction based on facility procedures.

Crossword Puzzle 1—Terms from Objectives 1 Through 6

Name _____ Date _____



ACROSS

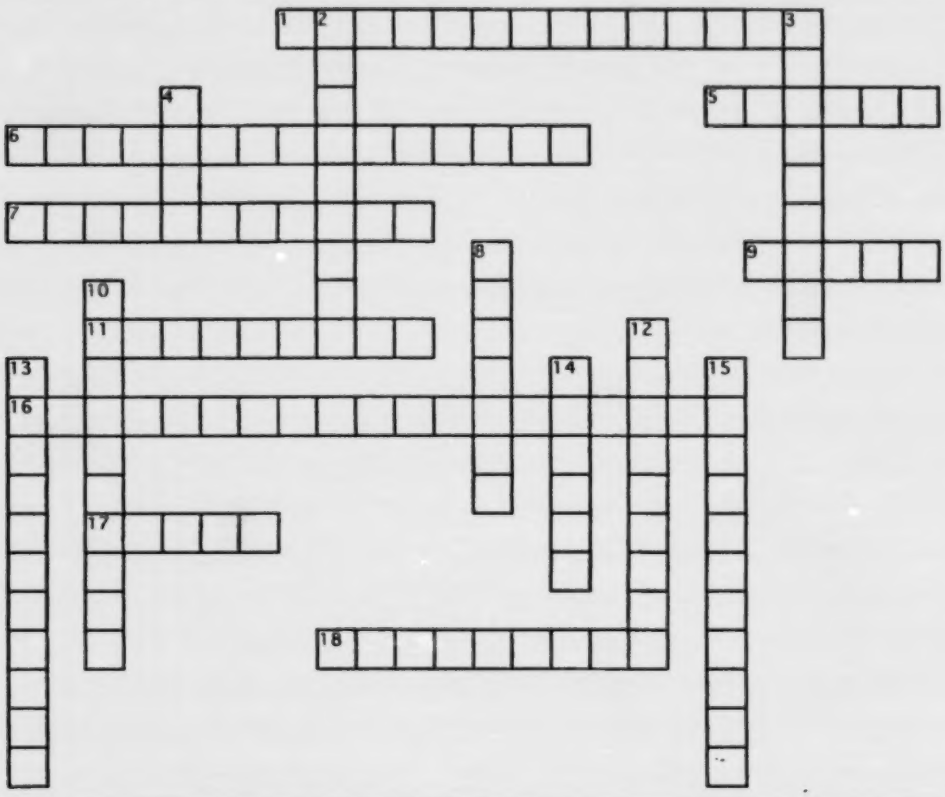
1. The layer of spongy bone tissue within the plates of the skull
3. One of the cells that forms cartilage
5. The intercellular substance in tissue
10. The ankle bones that form the heel and the proximal or posterior half of the foot
13. Any one of numerous small, round, bony masses embedded in certain tendons that may be subjected to compression and tension
14. All of the bones and cartilage of the body that collectively provide the supporting framework for the muscles and organs (2 words)
15. The bones of the skull, particularly the bones that enclose the brain (2 words)

DOWN

2. The kneecap
4. The basic bone cell
6. The flat portion of the hip
7. A specialized osteocyte that forms the wall of the marrow cavity
8. The wrist bones
9. One of the bony or cartilaginous segments composing the spinal column
11. A shoulder blade
12. Any of the paired, curved, bony, or partly cartilaginous rods that stiffen the walls of the body

Crossword Puzzle 2—Terms from Objectives 7 Through 9

Name _____ Date _____



ACROSS

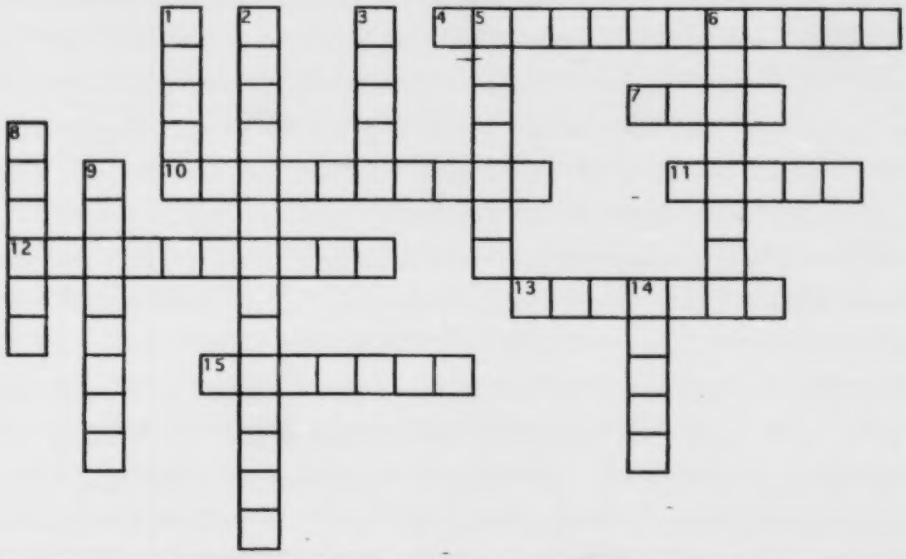
1. The porous bone tissue that is normally present in the interior of many bones where the spaces are usually filled with marrow (2 words)
5. The long bone on the thumb side of the forearm
6. The cavity that contains the bone marrow (2 words)
7. The hard, dense tissue that is usually found at the surface of a bone (2 words)
9. The thighbone; the longest, strongest bone in the body
11. The part or process of a bone that ossifies separately and later becomes ankylosed to the main part of the bone; one of the ends of a long bone
16. A thin layer of cartilage between the epiphysis and the diaphysis (2 words)
17. The shin bone; the largest bone in the lower leg
18. The miniature long bones of the fingers and the miniature long bones of the toes

DOWN

2. The union of separate bones or hard parts to form a single bone or part
3. The layer of vascular connective tissue lining the medullary cavity of a bone
4. The long bone on the little-finger side of the forearm
8. The long bone in the upper arm
10. The fibrous vascular membrane covering a bone, except at the extremities
12. The shaft of a long bone
13. The long bones forming the framework of the palm of the hand
14. The long, slender bone on the lateral side of the lower leg
15. The long bones that form the framework of the sole of the foot

Crossword Puzzle 3—Terms from Objectives 10 Through 13

Name _____ Date _____



ACROSS

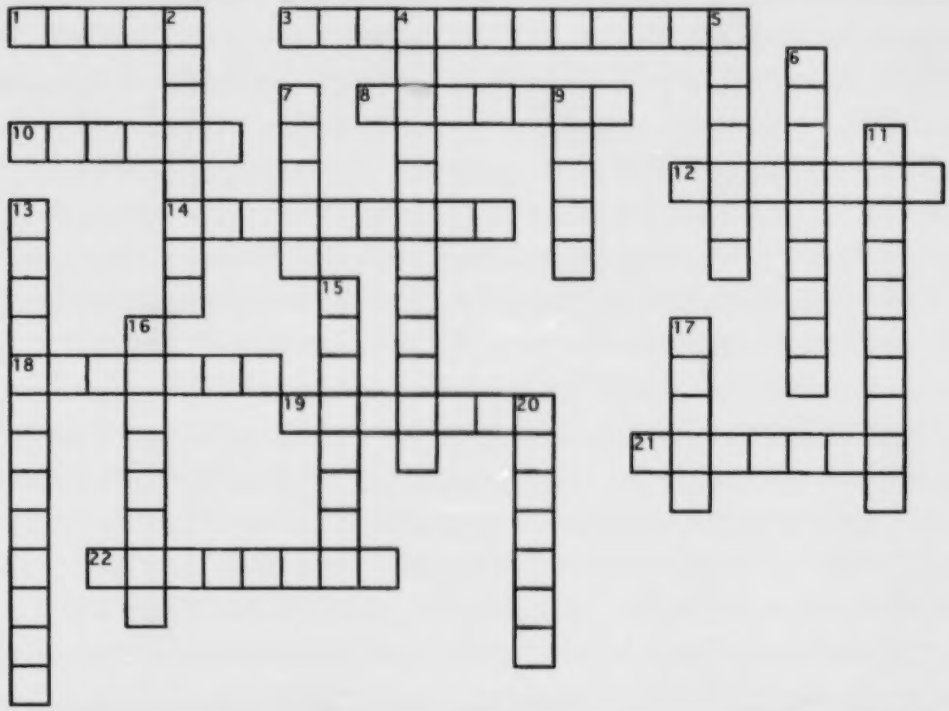
4. The _____ skeleton consists of the bones of the appendages that are attached to the axial skeleton and includes the bones of the shoulders, pelvis, arms, and legs; contains 126 bones
7. A process that forms a joint at the end of a narrowed structure called a *neck*
10. A very large process to which muscles attach
11. A cavity in bone that is lined with mucous membrane
12. A large rounded projection on a bone
13. A hole in a bone
15. A rounded process that generally mates with another to form a joint

DOWN

1. A ridge on a bone
2. A sharp projection on a bone (2 words)
3. A depression or hollow area in a bone
5. A projection of a bone
6. The collarbone
8. A tubular opening or passage in a bone
9. A small rounded projection on a bone
14. The _____ skeleton centers around the vertebral column and includes the bones of the skull, the ribs and sternum, and the vertebral column; contains 80 bones

Crossword Puzzle 4—Terms from Objective 14

Name _____ Date _____



ACROSS

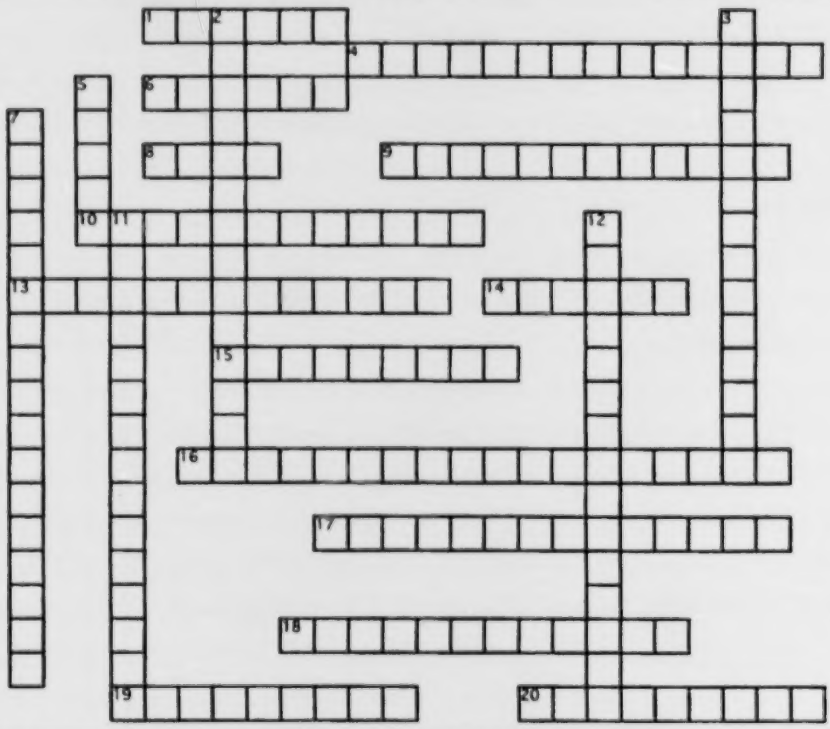
1. One of the three bones of the middle ear, resembling an anvil
3. Either of a pair of compound bones at the side of the skull that contains various cavities and recesses associated with the ear (2 words)
8. The single bone that forms the front of the skull is called the _____ *bone*
10. One of the three bones of the middle ear, resembling a tiny stirrup
12. The suture extending across the skull between the parietal and frontal bones is the _____ *suture*
14. The cuplike bone at the back of the skull that is marked by a large opening by which the skull articulates with the atlas is called the _____ *bone*
18. One of the three bones of the middle ear, resembling a hammer with a head, neck, and three processes
19. The bony part of the skull that holds the brain
21. One of a pair of large bones that form the upper jaw
22. The large bone that forms the lower jaw

DOWN

2. The winged compound bone of the base of the skull and anterior to the temporal bone is called the _____ *bone*
4. Either of a pair of bones of the roof of the skull between the frontal bone and the occipital bone (2 words)
5. A light, spongy, cubical bone forming much of the walls of the nasal cavity and part of those of the orbits is called the _____ *bone*
6. The process of a temporal bone that extends toward a zygomatic bone is called the _____ *process*
7. One of a pair of bony, conical cavities in the skull that accommodate the eyeballs and associated structures
9. The first vertebra of the neck
11. The serrated suture between the occipital bone and the parietal bones of the skull is the _____ *suture*
13. One of a pair of bones that forms the prominence of the cheek and part of the orbit; a cheekbone (2 words)
15. One of the smallest and most-fragile bones of the face, located at the anterior part of the medial wall of the orbit is called the _____ *bone*
16. The portion of the maxilla or the mandible that forms the dental arch is called the _____ *process*
17. The bone forming the nasal cavity is called the _____ *bone*
20. The process of a temporal bone that extends behind an ear is called the _____ *process*

Crossword Puzzle 5—Terms from Objectives 16 Through 26

Name _____ Date _____



ACROSS

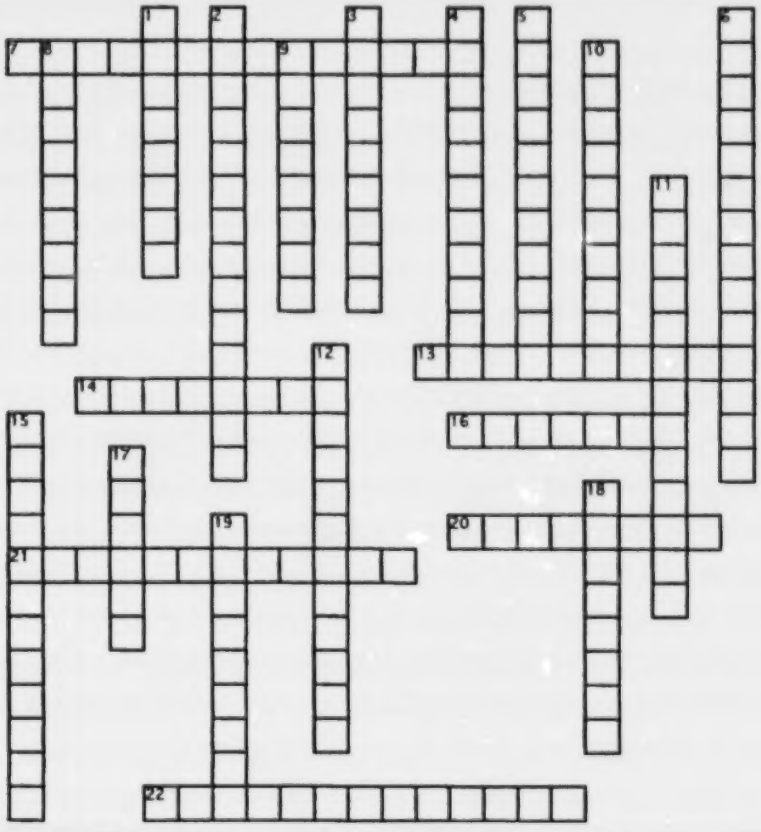
1. The large, triangular bone at the dorsal part of the pelvis, inserted like a wedge between the two hip bones
4. The region consisting of 12 segments of the upper-back portion of the vertebral column, designated T1 to T12 (2 words)
6. The organ of voice that is part of the air passage
8. The second cervical vertebra about which the atlas rotates, allowing the head to be turned, extended, and flexed
9. The region consisting of the five largest segments of the movable part of the vertebral column, designated L1 to L5 (2 words)
10. The region consisting of five segments of the vertebral column that fuse in the adult to form the sacrum (2 words)
13. The weight-supporting, solid central portion of a vertebra (2 words)
14. The beaklike bone joined to the sacrum by a disc of fibrocartilage at the base of the vertebral column
15. The middle section of the sternum
16. One of the fibrous discs found between adjacent vertebrae, except for the axis and the atlas (2 words)
17. The bony projection extending posteriorly from a vertebral body (2 words)
18. A joint or junction between bones or cartilages in the skeleton
19. The top section of the sternum
20. Resembling a knuckle

DOWN

2. The region of the vertebral column consisting of the first seven segments, designated C1 to C7 (2 words)
3. The lowest section of the sternum
5. The first cervical vertebra that articulates with the occipital bone and the axis
7. One of the bony projections extending at a right angle from a vertebral body (2 words)
11. The structures that create joints between bones that allow movement of the body parts (2 words)
12. The region consisting of four segments of the vertebral column that fuse to form the adult coccyx; the segments of this region are considered rudimentary vertebrae (2 words)

Crossword Puzzle 6—Terms from Objective 27

Name _____ Date _____



ACROSS

7. A neoplasm of the bone that usually exhibits itself as a spur on a long bone and that generally remains benign
13. A cell that breaks down bone by reabsorbing bone matrix as part of the growth-and-repair process
14. Exaggerated curvature of the spinal column in the thoracic region
16. _____ cartilage is the most-common type of cartilage; the translucent bluish-white cartilage found on the bones, in most joints, and in the nasal passages
20. An inflammation of the sac of synovial fluid that is found between some tendons and bones
21. A neoplasm of the bone that is usually malignant and metastatic
22. An inflamed condition of a bone caused by infection with a pathogen

DOWN

1. Exaggerated curvature of the spinal column in the lumbar region
2. A neoplasm of the hyaline cartilage that is usually malignant
3. A disease that leads to inflammation of the joints, resulting in stiff, painful joints
4. An inflammation of the air spaces in the mastoid region of the temporal bone
5. A congenital condition in which the bones that separate the oral and nasal cavities do not fuse (2 words)
6. The process of a substance converting to or absorbing inorganic substances, such as salts
8. Side-to-side curvature of the spinal column
9. An abnormal cellular growth; a tumor
10. Prone to metastasis—the spread of a disease from one region of the body to another
11. A condition in which the outer layer of the fibrous cartilage between vertebrae ruptures, resulting in stiffness, severe pain, and interference with nerve functioning (2 words)
12. A condition in which bone matrix is lost and not replaced, resulting in weakened bones and possible curvature of the spine
15. A bone disease characterized by poor mineralization of the bone
17. A condition of older adults in which there is a rapid and disorganized increase in osteoclasts is known as _____ disease
18. A deficiency of vitamin D that can often lead to poor or abnormal bone growth in children
19. Tending to spread and become more severe, especially of cancer

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. DIPLOE
3. CHONDROCYTE
5. MATRIX
10. TARSALS
13. SESAMOID
14. SKELETAL SYSTEM
15. CRANIAL BONES

DOWN
2. PATELLA
4. OSTEOCYTE
6. ILIUM
7. OSTEOBLAST
8. CARPALS
9. VERTEBRA
11. SCAPULA
12. RIB

Crossword Puzzle 2

ACROSS
1. CANCELLOUS BONE
5. RADIUS
6. MEDULLARY CAVITY
7. COMPACT BONE
9. FEMUR
11. EPIPHYSIS
16. EPIPHYSEAL CARTILAGE
17. TIBIA
18. PHALANGES

DOWN
2. ANKYLOSIS
3. ENDOSTEUM
4. ULNA
8. HUMERUS
10. PERIOSTEUM
12. DIAPHYSIS
13. METACARPALS
14. FIBULA
15. METATARSALS

Crossword Puzzle 3

ACROSS
4. APPENDICULAR
7. HEAD
10. TROCHANTER
11. SINUS
12. TUBEROSITY
13. FORAMEN
15. CONDYLE

DOWN
1. CREST
2. SPINOUS PROCESS
3. FOSSA
5. PROCESS
6. CLAVICLE
8. MEATUS
9. TUBERCLE
14. AXIAL

Crossword Puzzle 4

ACROSS
1. INCUS
3. TEMPORAL BONE
8. FRONTAL
10. STAPES
12. CORONAL
14. OCCIPITAL
18. MALLEUS
19. CRANIUM
21. MAXILLA
22. MANDIBLE

DOWN
2. SPHENOID
4. PARIETAL BONE
5. ETHMOID
6. ZYGOMATIC
7. ORBIT
9. ATLAS
11. LAMBDOIDAL
13. ZYGOMATIC BONE
15. LACRIMAL
16. ALVEOLAR
17. NASAL
20. MASTOID

Crossword Puzzle 5

ACROSS
1. SACRUM
4. THORACIC REGION
6. LARYNX
8. AXIS
9. LUMBAR REGION
10. SACRAL REGION
13. VERTEBRAL BODY
14. COCCYX
15. GLADIOLUS
16. INTERVERTEBRAL DISC
17. SPINOUS PROCESS
18. ARTICULATION
19. MANUBRIUM
20. CONDYLOID

DOWN
2. CERVICAL REGION
3. XIPHOID PROCESS
5. ATLAS
7. TRANSVERSE PROCESS
11. ARTICULAR SYSTEM
12. COCCYGEAL REGION

Crossword Puzzle 6

ACROSS
7. OSTEOCHONDROMA
13. OSTEOCLAST
14. KYPHOSIS
16. HYALINE
20. BURSITIS
21. OSTEOSARCOMA
22. OSTEOMYELITIS

DOWN
1. LORDOSIS
2. CHONDROSARCOMA
3. ARTHRITIS
4. MASTOIDITIS
5. CLEFT PALATE
6. MINERALIZATION
8. SCOLIOSIS
9. NEOPLASM
10. METASTATIC
11. HERNIATED DISC
12. OSTEOPOROSIS
15. OSTEOMALACIA
17. PAGETS
18. RICKETTS
19. MALIGNANT

Module Review

Name _____

Date _____ Score _____

Directions Read each item. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 14

1. The _____ is one of the smallest and most-fragile bones of the face.

   a. lacrimal bone

   b. maxilla

   c. mandible

   d. zygomatic process

Objective 16

2. Which of the following phrases is NOT a characteristic of the hyoid bone?

   a. is a segmented, O-shaped bone in the neck between the mandible and the lower part of the larynx

   b. is the only bone in the body that does not articulate with another bone

   c. is suspended by ligaments on processes from the temporal bone in the cranium

   d. provides an attachment for the tongue

Objective 17

3. The _____ is the weight-supporting, solid central portion of a vertebra.

   a. transverse process

   b. spinous process

   c. vertebral body

   d. intervertebral disc

Objective 19

4. Which of the following is NOT a section of the sternum?

   a. manubrium

   b. gladiolus

   c. marigolus

   d. xiphoid process

Objective 12

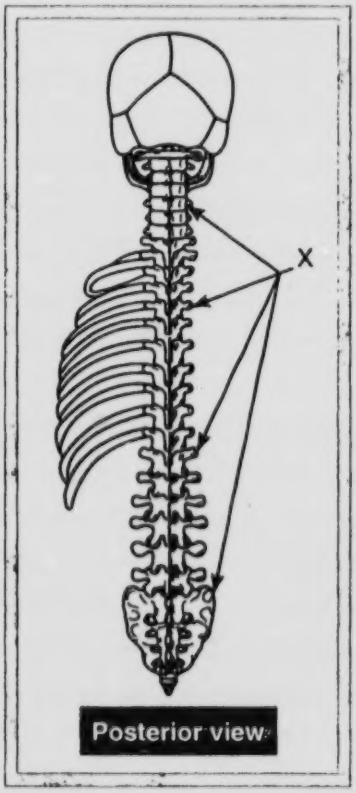
5. The items indicated by the letter "X" in the illustration below are _____.

   a. the ribs

   b. the bones of the sternum

   c. the bones of the clavicle

   d. the vertebrae of the vertebral column



Objective 19

6. There are a total of _____ rib pairs.

   a. 7

   b. 10

   c. 12

   d. 16

Objective 13

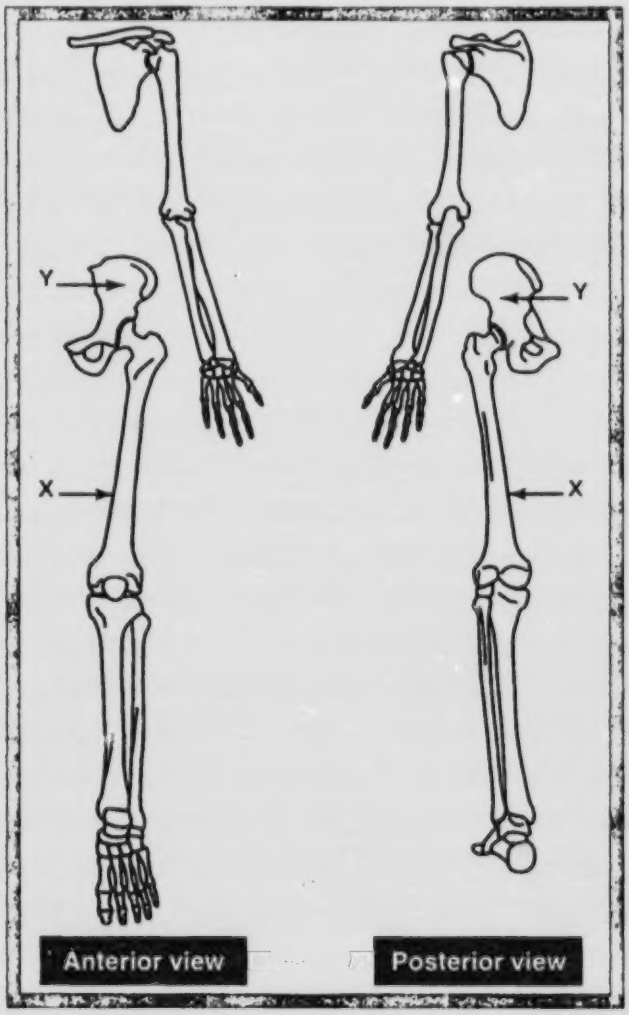
7. The item indicated by the letter "X" in the illustration below is the _____.

   a. tibia

   b. fibia

   c. tarsal

   d. femur



Objective 13

8. The item indicated by the letter "Y" in the illustration above is the _____.

   a. patella

   b. ilium

   c. humerus

   d. femur

Objective 15

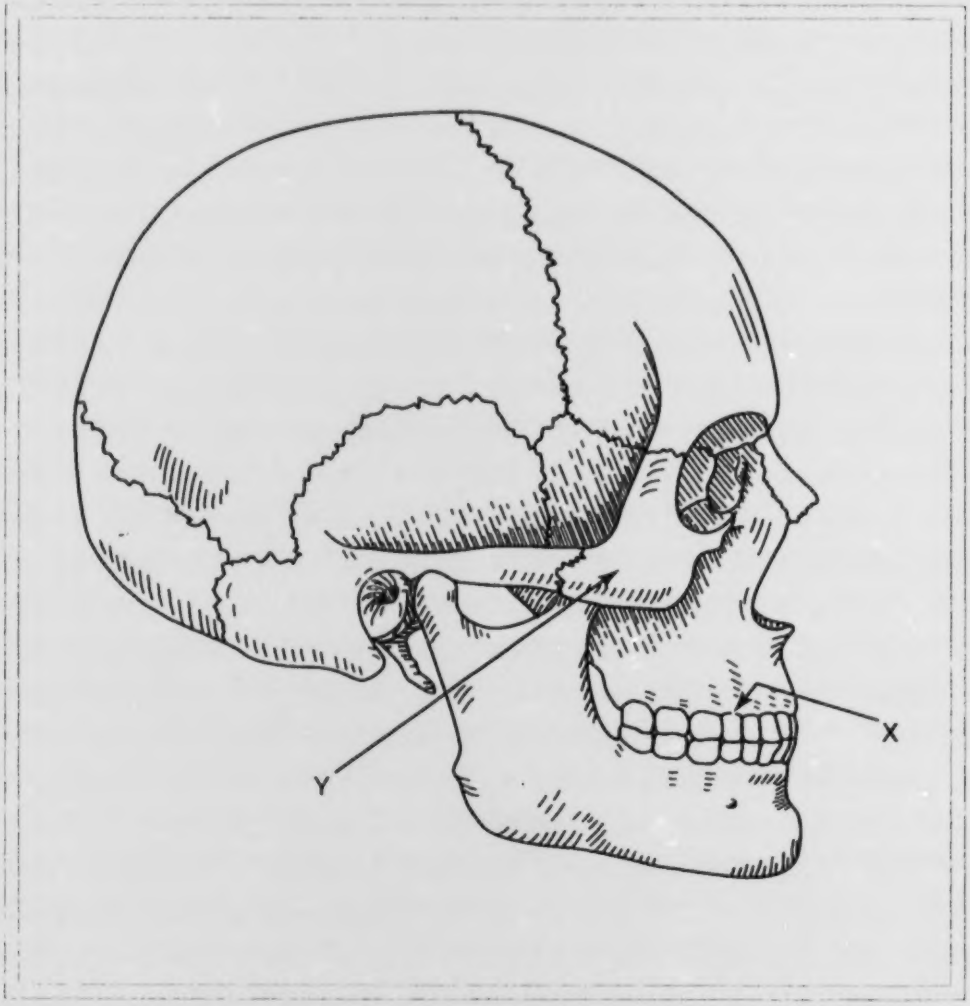
9. The item indicated by the letter "X" in the illustration below is the _____.

   a. alveolar process of the mandible

   b. alveolar process of the maxilla

   c. lacrimal bone

   d. mandible



Objective 15

10. The item indicated by the letter "Y" in the illustration above is the _____.

   a. lacrimal bone

   b. maxilla

   c. mandible

   d. zygomatic bone

Objective 11

11. The two major divisions of the human skeleton are the _____ and the _____.

a. vertical; horizontal

b. true; false

c. axial; appendicular

d. osteotic; cartilaginous

Objective 23

12. Synovial fluid is secreted by the _____.

a. lymph glands

b. synovial membrane

c. synovial sinus

d. sesamoid duct

Objective 24

13. Which of the following is NOT true of synarthrosis articulations?

a. They have a joint cavity.

b. They consist of fibrous cartilage or bone tissue that grows between the articulating surfaces.

c. They include the distal tibiofibular joint.

d. They include sutures in the skull.

Objective 11

14. Which of the following is in the appendicular skeleton?

a. the ribs

b. the bones of the shoulders

c. the sternum

d. the bones of the vertebral column

Objective 24

15. _____ are freely movable joints.

a. Synarthrosis articulations

b. Amphiarthrosis articulations

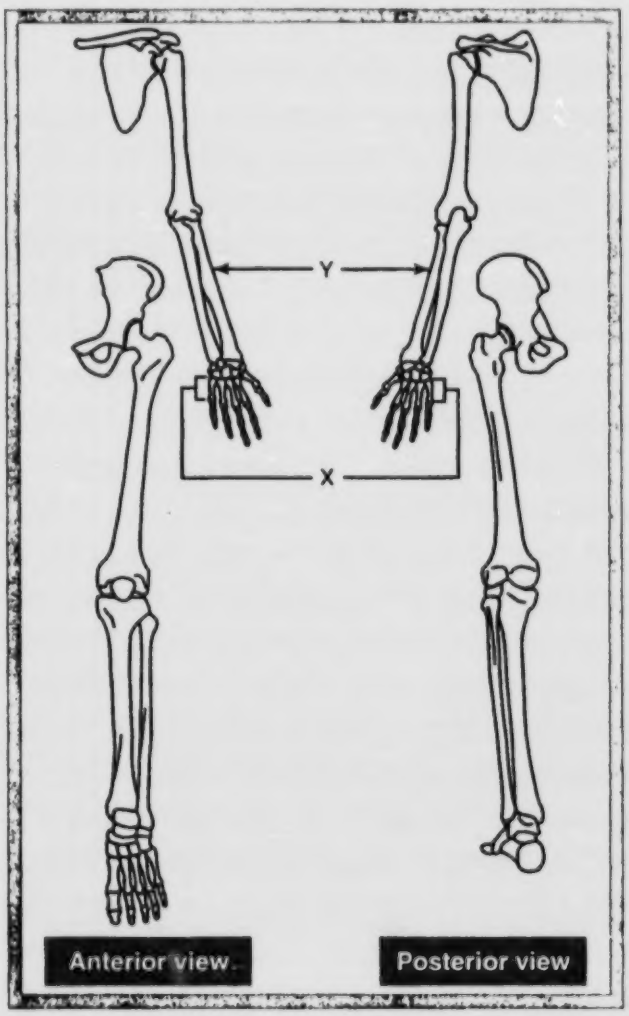
c. Diathrosis articulations

d. Epithrosis articulations

Objective 13

16. The items indicated by the letter "X" in the illustration below are the _____.

    a. phalanges
    b. carpals
    c. tarsals
    d. metacarpals



Objective 13

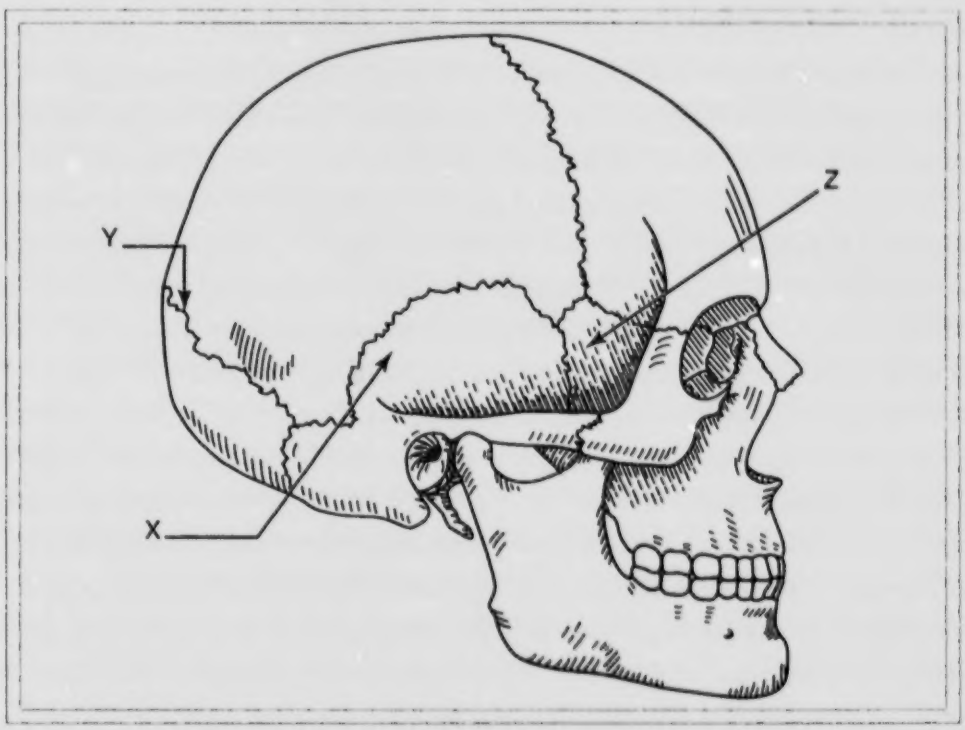
17. The item indicated by the letter "Y" in the illustration above is the _____.

    a. ulna
    b. radius
    c. humerus
    d. femur

Objective 15

18. The item indicated by the letter "X" in the illustration below is the _____.

    a. sphenoid bone
    b. parietal bone
    c. temporal bone
    d. occipital bone



Objective 15

19. The item indicated by the letter "Y" in the illustration above is the _____.

    a. lamboidal suture
    b. mastoid process
    c. zygomatic process
    d. coronal suture

Objective 15

20. The item indicated by the letter "Z" in the illustration above is the _____.

    a. sphenoid bone
    b. parietal bone
    c. frontal bone
    d. ethmoid bone

Objective 7

21. The part of a long bone that contains the marrow is called the _____ *cavity.*

    a. *cartilaginous*

    b. *epiphyseal*

    c. *medullary*

    d. *articular*

Objective 15

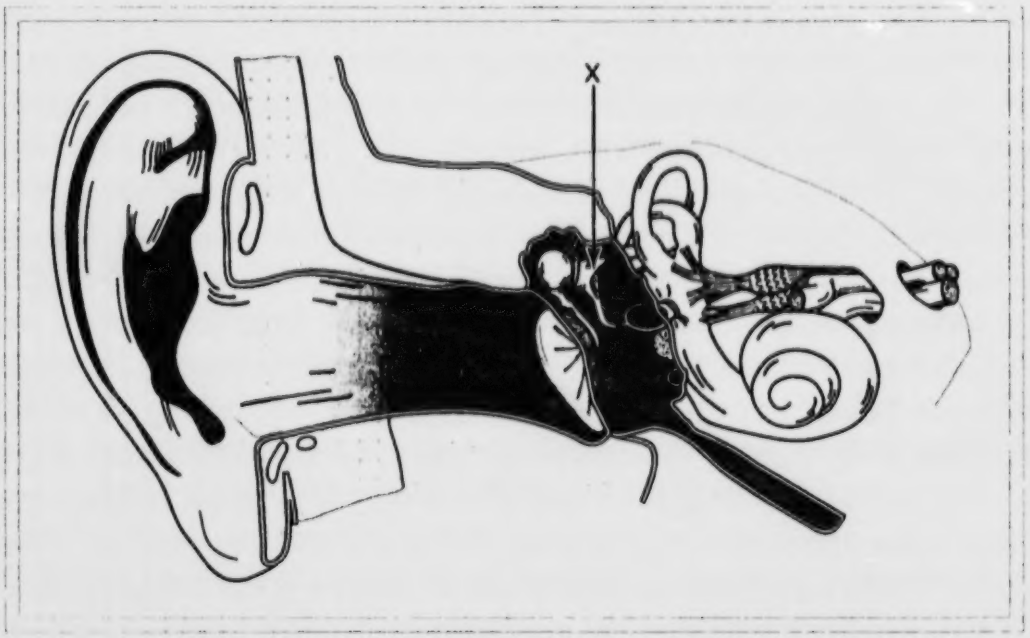
22. The item indicated by the letter "X" in the illustration below is the _____ of the middle ear.

    a. malleus

    b. incus

    c. stapes

    d. eardrum



Objective 17

23. Which of the following statements is NOT true concerning the major bones and structures of the vertebral column?

    a. The axis is the second cervical vertebra.

    b. The atlas is the second cervical vertebra.

    c. The atlas articulates with the occipital bone and the axis.

    d. The axis allows the head to be turned, extended, and flexed.

Objective 17

24. Which of the following is the correct listing of the regions of the vertebral column in order from the skull going down?

    a. cervical, lumbar, thoracic, sacral, coccygeal

    b. cervical, thoracic, lumbar, sacral, coccygeal

    c. cervical, thoracic, lumbar, coccygeal, sacral

    d. cervical, lumbar, thoracic, coccygeal, sacral

Objective 7

25. The shaft of a long bone is called _____.

    a. a *diaphysis*

    b. an *epiphysis*

    c. an *osteoblast*

    d. a *projection*

Objective 10

26. A trochanter is _____.

    a. a very large process to which muscles attach

    b. a ridge on a bone

    c. a sharp projection on a bone

    d. a process that forms a joint at the end of a narrowed structure called a *neck*

Objective 9

27. The miniature long bones of the fingers and toes are called _____.

    a. *carpals*

    b. *metacarpals*

    c. *tarsals*

    d. *phalanges*

Objective 18

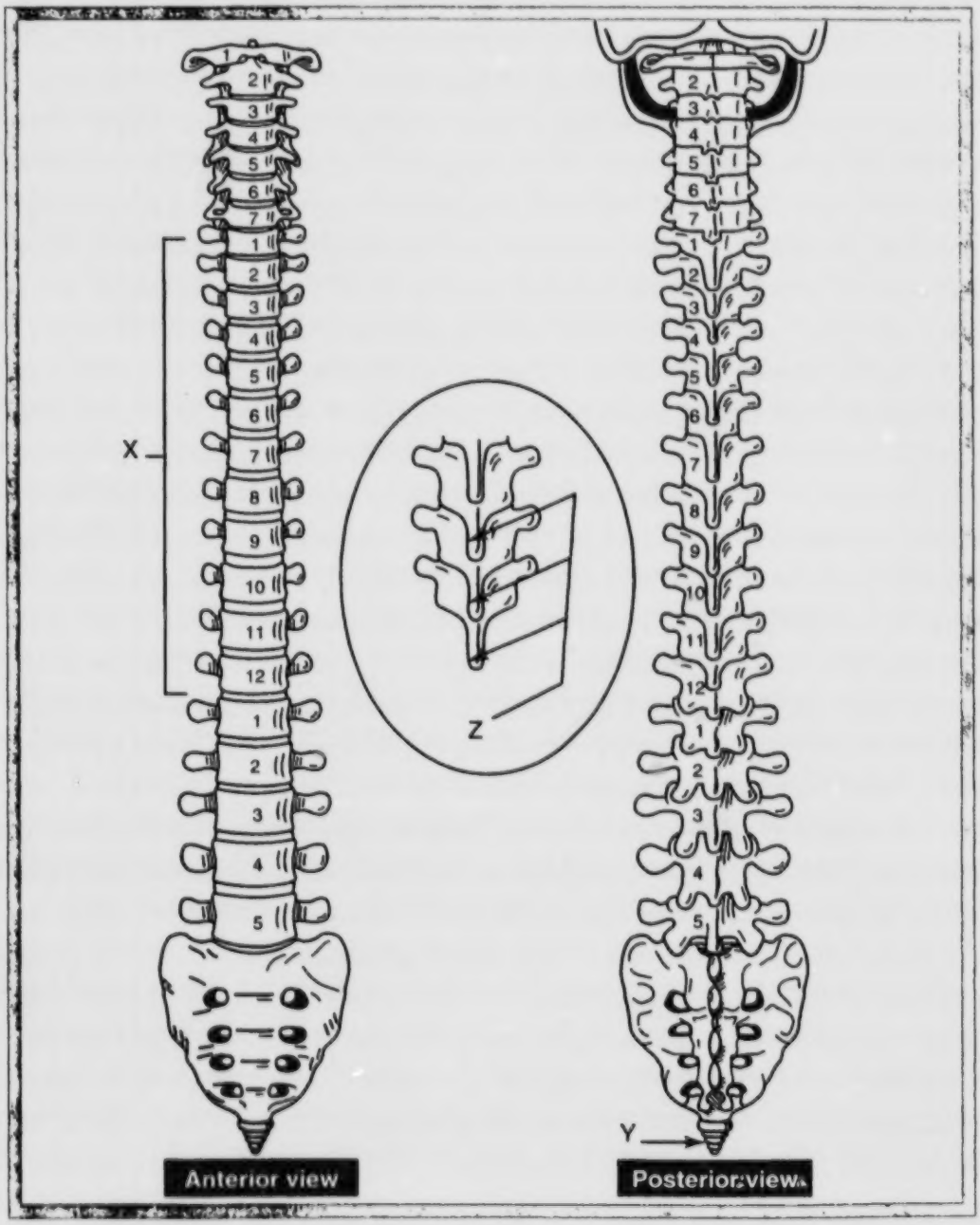
28. The item indicated by the letter "X" in the illustration below is the _____ region of the vertebral column.

a. coccygeal

b. lumbar

c. cervical

d. thoracic



Objective 18

29. The item indicated by the letter "Y" in the illustration in Question 28 on the previous page is the _____.

    a. coccyx

    b. sacrum

    c. atlas

    d. axis

Objective 18

30. The item indicated by the letter "Z" in the illustration in Question 28 on the previous page is the _____ of a vertebra.

    a. intervertebral disc

    b. vertebral body

    c. spinous process

    d. transverse process

Objective 3

31. Bone matrix is composed of _____.

    a. calcium salts and collagen

    b. proteins

    c. cartilage and compact bone tissue

    d. organic salts and connective tissue

Objective 3

32. A chondrocyte is _____.

    a. the basic bone cell

    b. the intercellular substance in tissue

    c. one of the cells that forms cartilage

    d. a specialized osteocyte that forms the wall of the marrow cavity

Objective 19

33. All ribs attach to the _____ region of the vertebral column.

    a. sacral

    b. lumbar

    c. thoracic

    d. coccygeal

Objective 24

34. _____ are slightly movable joints.

a. Synarthrosis articulations

b. Amphiarthrosis articulations

c. Diathrosis articulations

d. Epithrosis articulations

Objective 5

35. An example of a sesamoid bone is the _____.

a. elbow

b. trachea

c. nasal septum

d. patella

Objective 27

36. Cleft palate is a congenital condition in which the bones that separate the _____ cavities do not fuse.

a. oral and nasal

b. abdominal and thoracic

c. medullary

d. matrix

Objective 9

37. The long bones forming the framework of the palm of the hand are called _____.

a. *carpals*

b. *metacarpals*

c. *tarsals*

d. *phalanges*

Objective 2

38. One function of the skeletal system is to store _____ and _____.

a. calcium; phosphorus

b. calcium; carbonate

c. phosphorus; carbonate

d. none of the above; the skeletal system has no storage function

Objective 20

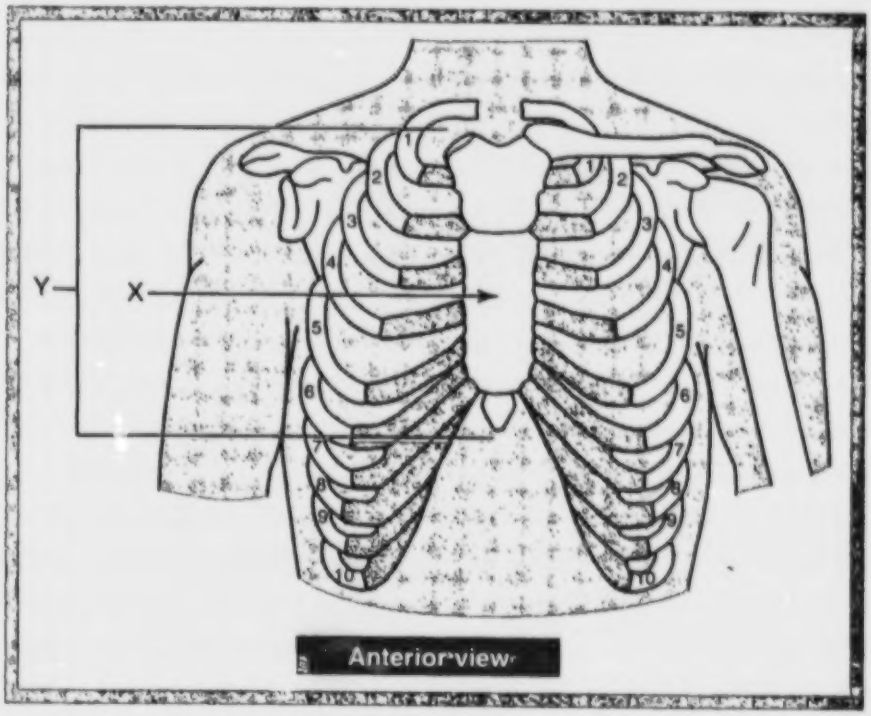
39. The item indicated by the letter "X" in the illustration below is the _____.

a. manubrium

b. gladiolus

c. xiphoid process

d. sternum



Objective 20

40. The item indicated by the letter "Y" in the illustration above is the _____.

a. manubrium

b. gladiolus

c. xiphoid process

d. sternum

Objective 26

41. What type of diathrosis articulation provides the widest range of motion with movement in all planes in addition to rotation?

a. ball-and-joint socket

b. hinge joint

c. pivot joint

d. condyloid joint

Objective 24

42. Which of the following statements is NOT true of diathrosis articulations?

a. They have a joint cavity enclosed by an articular cavity.

b. They are immovable.

c. They include the hip and femur joint, knee, wrist, elbow, and shoulder joints.

d. They have ligaments that cover and connect the ends of the opposing bones.

Objective 26

43. The joint between the carpals and the thumb metacarpals is an example of a type of diathrosis joint called a _____ *joint.*

a. *saddle*

b. *gliding*

c. *sliding*

d. *condyloid*

Objective 1

44. The skeletal system consists of all the _____ and _____ of the body.

a. muscles; organs

b. bones; cartilage

c. muscles; ligaments

d. joints; blood

Objective 27

45. Osteomyelitis is an inflamed condition of a bone caused by _____.

a. infection with a pathogen

b. genetic defects

c. trauma

d. poor diet

Objective 5

46. Short bones contain _____ bone marrow in the spongy bone.

a. white

b. yellow

c. red

d. no

Objective 7

47. The periosteum is the _____.

a. layer of vascular connective tissue lining the medullary cavity

b. fibrous vascular membrane covering a bone, except at the extremities

c. thin layer of cartilage between the epiphysis and the bone shaft

d. hard, dense tissue that is usually found at the surface of a bone

Objective 24

48. _____ are immovable joints.

a. Synarthrosis articulations

b. Amphiarthrosis articulations

c. Diathrosis articulations

d. Epithrosis articulations

Objective 8

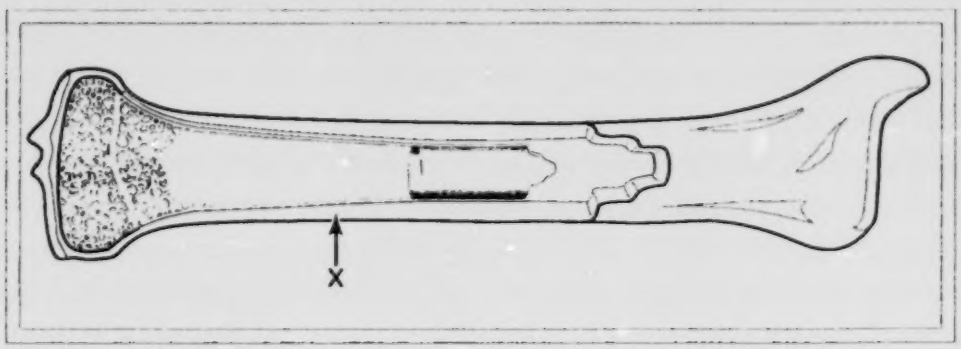
49. The item indicated by the letter "X" in the illustration below is the _____.

a. periosteum

b. endosteum

c. epiphysis

d. epiphyseal cartilage



Objective 9

50. Two of the long bones of the lower leg are the _____ and the _____.

a. tibia; fibula

b. ulna; radius

c. femur; humerus

d. scapula; patella

Objective 2

51. Which of the following is NOT a function of the skeletal system?

a. provides support and shape for the body

b. protects delicate vital organs

c. assists with body movements

d. manufactures muscle cells

Objective 10

52. A hole in a bone is _____.

a. a foramen

b. a meatus

c. a sinus

d. an orifice

Objective 28

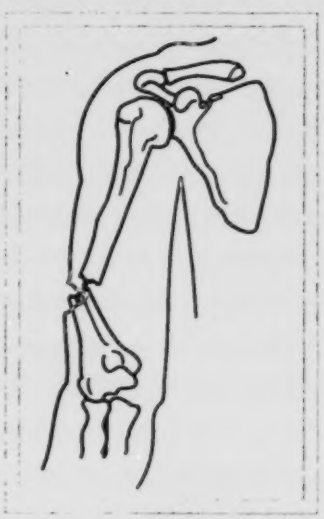
53. Which of the following terms should be used to describe the fracture in the illustration below?

a. compound

b. complete

c. neither "a" nor "b"

d. both "a" and "b"



Objective 28

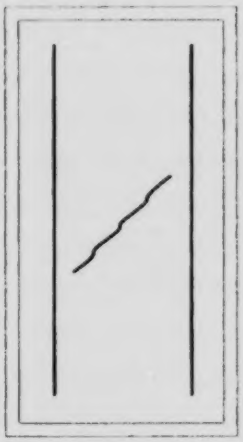
54. What is the geometry of the fracture shown in the illustration below?

a. linear

b. transverse

c. oblique

d. none of the above



Objective 10

55. A large rounded projection on a bone is _____.

a. a tubercle

b. a tuberosity

c. a condyle

d. a sinus

Objective 5

56. Flat bones include the ribs, scapulae, ilium, and _____.

a. carpals

b. tarsals

c. vertebrae

d. cranial bones

Objective 5

57. Which type of bones contain yellow bone marrow?

a. long bones

b. short bones

c. irregular bones

d. flat bones

Objective 4

58. Which of the following is NOT a major material that composes bones?

a. blood vessels

b. inorganic salts

c. hormones

d. water

Objective 3

59. Which of the following statements is true of cartilage?

a. Cartilage is firm, yet flexible.

b. Cartilage is composed of osteocytes.

c. Cartilage has no matrix.

d. Cartilage has a good blood supply.

Objective 3

60. Bones consist of cells called _____.

a. *chondrocytes*

b. *osteocytes*

c. *leukocytes*

d. *ossificytes*

Objective 5

61. _____ bones are found in the arms, legs, hands, and feet.

a. Short

b. Long

c. Flat

d. Irregular

Objective 6

62. Which of the following phrases is NOT a characteristic of bone marrow?

a. is a soft, sponge-like material found in the cavities of bones

b. is a network of blood vessels and special connective tissue that holds together fat and blood-producing cells

c. is red in the diploe, ribs, sternum, vertebral bones, and proximal epiphysis of the humeri and femurs

d. is yellow in most bones, consisting primarily of proteins

Objective 20

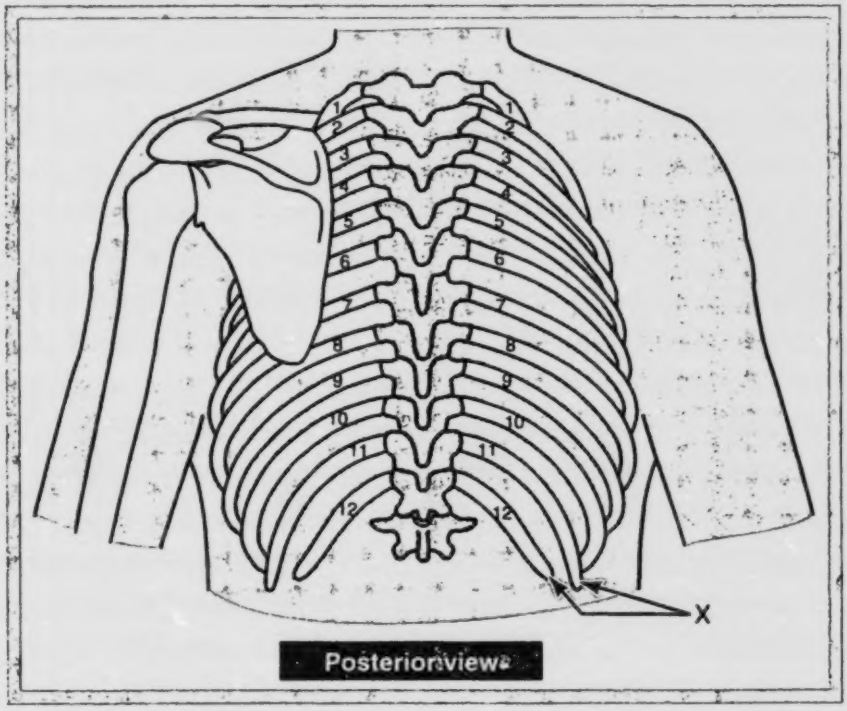
63. The items indicated by the letter "X" in the illustration below are _____.

a. the true ribs

b. the false ribs

c. the floating ribs

d. the vertebral column



Objective 5

64. Which of the following statements is NOT true of sesamoid bones?

a. They are found in the small bones in the hands and feet.

b. They consist of cartilage that ossifies with age.

c. They often develop in new locations due to the use of tendons.

d. They produce blood cells until the person fully matures.

Objective 28

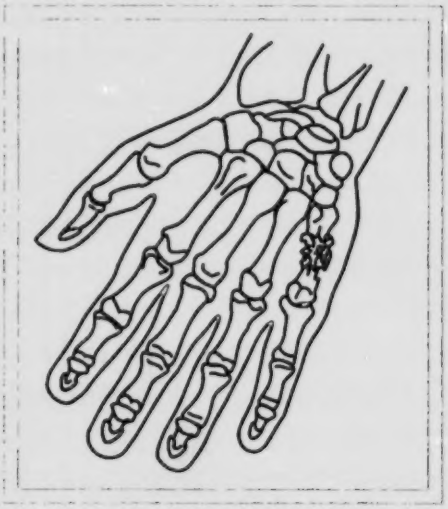
65. What is the relationship of the bones and the extent of separation of the fracture shown in the illustration below?

a. simple, complete

b. simple, incomplete

c. comminuted, complete

d. compound, incomplete



Objective 19

66. How many pairs of ribs attach directly to the sternum and are referred to as *true ribs*?

a. 2

b. 3

c. 5

d. 7

Objective 13

67. Another name for the collarbone is the _____.

a. humerus

b. clavicle

c. ilium

d. radius

Objective 14

68. The major bones of the ear are the _____, _____, and _____.

a. mandible; inca; palatine

b. outer; middle; inner

c. long; short; curved

d. malleus; incus; stapes

Objective 26

69. The knee, elbow, and finger joints are examples of the type of diathrosis articulation called the _____ *joint.*

a. *saddle*

b. *hinge*

c. *pivot*

d. *condyloid*

Objective 17

70. The region of the vertebral column that consists of the five largest segments of the movable part of the vertebral column is the _____.

a. lumbar region

b. sacral region

c. coccygeal region

d. thoracic region

Objective 27

71. _____ is an inflammation of the sac of synovial fluid that is found between some tendons and bones.

a. Arthritis

b. Mastoiditis

c. Phlebitis

d. Bursitis

Objective 28

72. A break in a bone in which the bone penetrates the skin is called _____ *fracture.*

a. a *compound*

b. a *greenstick*

c. an *impacted*

d. a *comminuted*

Objective 5

73. _____ bones are made of spongy bone covered with compact bone.

a. Long

b. Short

c. Irregular

d. all of the above

Objective 8

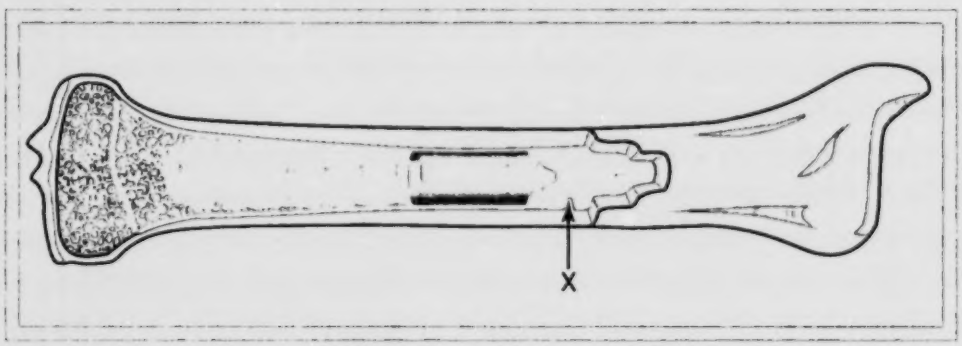
74. The item indicated by the letter "X" in the illustration below is _____.

a. cancellous bone

b. compact bone

c. epiphyseal cartilage

d. articular cartilage



Objective 5

75. The _____ are examples of irregular bones.

a. carpals

b. tarsals

c. vertebrae

d. cranial bones

Objective 14

76. Which of the following statements is NOT true of the cranium?

a. The cranium is the bony part of the skull that holds the brain.

b. The cranium is composed of eight bones.

c. The parietal bone of the cranium is located at the side of the skull and contains various cavities.

d. The occipital bone of the cranium is a cuplike bone at the back of the skull.

Objective 27

82. _____ is a neoplasm of the bone that is usually malignant and metastatic.

a. Chondrosteosarcoma

b. Chondrosarcoma

c. Osteochondroma

d. Osteosarcoma

Objective 7

83. _____ is the union of separate bones or hard parts to form a single bone or part.

a. Diaphysis

b. Epiphysis

c. Compact bone

d. Ankylosis

Objective 17

84. The first vertebra of the neck is called the _____.

a. *sphenoid bone*

b. *ethmoid bone*

c. *orbit*

d. *atlas*

Objectives 21 & 22

85. Which of the following statements is NOT true concerning the articular system.

a. The articular system consists of the structures that create joints between bones that allow movement of the body parts.

b. The articular system allows changes of position and body motion without bearing the weight of the body.

c. The articular system lubricates the joints.

d. The articular system nourishes the cartilaginous structures.

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d. The articular system nourishes the cartilaginous structures.

Objective 26

86. The _____ type of diathrosis articulation has a process that rotates around a bony fossa around a longitudinal axis.

a. ball-and-joint socket

b. hinge joint

c. pivot joint

d. condyloid joint

Objective 27

87. Ricketts is a deficiency of vitamin _____ that can often lead to poor or abnormal bone growth in children.

a. A

b. B

c. C

d. D

Objective 25

88. The joints between the ribs and sternum are examples of the _____ type of amphiarthrosis articulation.

a. cancellous

b. saggital

c. synchrondrosis

d. symphysis

Objective 27

89. A condition in which the outer layer of the fibrous cartilage between vertebrae ruptures is _____.

a. an epiphyseal disc

b. a herniated disc

c. an extruded vertebra

d. a herniated vertebra

Objective 23

90. _____ are connective tissue bands that hold bones together.

a. Ligaments

b. Tendons

c. Cartilaginous strictures

d. Articulating membranes

Objective 23

91. Which of the following phrases is NOT a characteristic of synovial fluid?

a. ensures that a joint is not moved beyond its normal range

b. acts as a shock absorber

c. provides a lubricated articulating surface for the adjacent bone

d. provides the major source of nutrition for the articular cartilage

Objective 23

92. Ligaments _____.

a. secrete a thick, colorless fluid that resembles the white of a raw egg

b. are smooth layers of cartilage that cover the ends of opposing bones

c. are only found in connection with the freely movable joints

d. help to reinforce and stabilize the joints

Objective 26

93. A _____ joint is a type of diathrosis articulation that has flat articular surfaces or matching slightly concave and slightly convex surfaces.

a. saddle

b. gliding

c. sliding

d. condyloid

Objective 25

94. The _____ type of amphiarthrosis articulations consists of bones growing together at a midline.

a. cancellous

b. saggital

c. synchrondrosis

d. symphysis

Objective 23

95. The _____ cover the ends of opposing bones and provide a smooth gliding surface for opposing bones.

a. articular cartilages

b. synovial junctions

c. epiphyseal discs

d. compact-bone processes

Objective 26

96. Which of the following is an example of a ball-and-joint socket?

a. the elbow

b. the humerus and scapula joint

c. the thumb and carpal joint

d. the cervical vertebra

Objective 27

97. Arthritis is a disease that leads to _____.

a. exaggerated curvature of the spine

b. inflammation of the sac of synovial fluid that is found between some tendons and bones

c. inflammation of the joints

d. herniated discs

Objective 19

98. Rib pairs _____ are not attached to the sternum and are called the *floating ribs*.

a. 8, 9, and 10

b. 11 and 12

c. 8 through 12

d. 1 through 7

Objective 17

99. Which of the following statements is NOT true concerning the major bones and structures of the vertebral column?

a. The sacrum is a large, triangular bone.

b. The coccyx is the beaklike bone joined to the sacrum.

c. The sacrum is inserted like a wedge between the transverse process and the spinous process.

d. The coccyx is joined to the sacrum by a disc of fibrocartilage.

Objective 17

100. The region at the upper-back portion of the vertebral column that consists of 12 segments is the _____.

a. lumbar region

b. sacral region

c. coccygeal region

d. thoracic region

Answers to Module Review

1. a	21. c	41. a	61. b	81. a
2. a	22. b	42. b	62. d	82. d
3. c	23. b	43. a	63. c	83. d
4. c	24. b	44. b	64. d	84. d
5. d	25. a	45. a	65. c	85. b
6. c	26. a	46. c	66. d	86. c
7. d	27. d	47. b	67. b	87. d
8. b	28. d	48. a	68. d	88. c
9. b	29. a	49. b	69. b	89. b
10. d	30. c	50. a	70. a	90. a
11. c	31. a	51. d	71. d	91. a
12. b	32. c	52. a	72. a	92. d
13. a	33. c	53. d	73. d	93. b
14. b	34. b	54. c	74. c	94. d
15. c	35. d	55. b	75. c	95. a
16. d	36. a	56. d	76. c	96. b
17. b	37. b	57. a	77. c	97. c
18. c	38. a	58. c	78. d	98. b
19. a	39. b	59. a	79. d	99. c
20. a	40. d	60. b	80. b	100. d

MODULE SET II:
Major Body Systems

Module 3: Muscular System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Muscular System	7
2—Major Classifications of Muscle Tissue	9
3—Major Structures of Skeletal Muscles	11
4—Major Muscles of the Neck, Head, and Face	13
5—Major Muscles of the Torso (Anterior View)	15
6—Major Muscles of the Torso (Posterior View)	17
7—Major Muscles of the Arms	19
8—Major Muscles of the Legs	21
Written Test	23
Answers to Written Test	37
Answers to Assignment Sheets	43
Crossword Puzzles	
1—Terms from Objectives 1 Through 8	45
2—Terms from Objectives 9 and 10	47
3—Terms from Objectives 11 Through 13	49
4—Terms from Objectives 14 Through 17	51
5—Terms from Objectives 18 and 19	53
6—Terms from Objective 20	55
Answers to Crossword Puzzles	57
Module Review	59
Answers to Module Review	75

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 5 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining sections in the student edition: assignment sheets.
- Have students complete the assignment sheets.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module has two primary purposes: to introduce students to the muscular system and to build the students' anatomy and physiology vocabularies. Look for opportunities to reinforce both goals as you present the module.

- Use cuts of meat from the butcher to show muscle textures, types, bone connections, tendons, etc.
- Use crossword puzzles 1 through 6 to help reinforce the terms in the associated objectives.
- To supplement Objective 1, which defines the term *muscular system*, use photos of muscle builders to illustrate the interrelatedness of the muscles that form the muscle system.
- To supplement Objective 2, which concerns the major functions of the muscular system, ask students to provide an example of each function. Based on their studies of tissue and the skeletal system, students should be able to come up with examples. Further challenge the students by having them relate types of muscle tissue to the various functions.
- To supplement Objective 3, which describes the major classifications of muscle tissue (skeletal, visceral, and cardiac), provide students with cuts of meat representative of the three classes of muscle tissue. Using these and illustrations, discuss the distinguishing characteristics of the three classes. Point out the typical body locations of each class of tissue. Discuss how the function of each class of muscle tissue relates to its structure and contraction rate.
- Use illustrations to supplement Objective 4 through Objective 7, which identify and define the major structures of skeletal muscles, describe the characteristics of the bone/muscle attachments of skeletal muscles, and describe how skeletal muscles function. Relate the structures of skeletal muscles and the characteristics of their attachments to their roles in performing muscle functions. Encourage students to locate different types of attachments on illustrations or other resources.
- Objective 8 defines the terms that describe the functional characteristics of muscle tissue: irritability, conductivity, extensibility, elasticity, contractility, and tone. To illustrate conductivity, set up an electrical circuit with a battery-powered light. Show how the light illuminates when the wires are connected to the battery. Use a large rubber band to illustrate extensibility and elasticity. Have students stand and allow their arms to hang loosely, and then point out that the slightly flexed tension of their arms demonstrates muscle tone.

- To supplement Objective 9, which describes the actions performed by the types of muscles as classified by their actions (abductor, adductor, levator, depressor, flexor, extensor, etc.), ask students to identify action terms that they are familiar with from their previous studies, and then, point out and discuss the new terms introduced in this objective, such as *sphincter* and *tensor*.

- Objective 10 defines terms that describe how muscles function during coordinated movement (prime mover, agonist, antagonist, synergist, fixator). Perform different movements of various limbs and have the students identify the agonist, antagonist, and prime mover in each movement.

- Objective 11 introduces the major muscle groups and states their general functions. Expand the objective by discussing the role of the specific muscles in each group, which are presented in Objective 12 through Objective 19.

- Objective 20 describes common disorders and abnormalities of the muscular system. Have students discuss common disorders such as cramps and convulsions, and invite a surgeon to discuss disorders and conditions such as botulism, tetanus, muscular dystrophy, etc.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.

- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.

- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.

- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.

- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.

- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.

- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.

- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

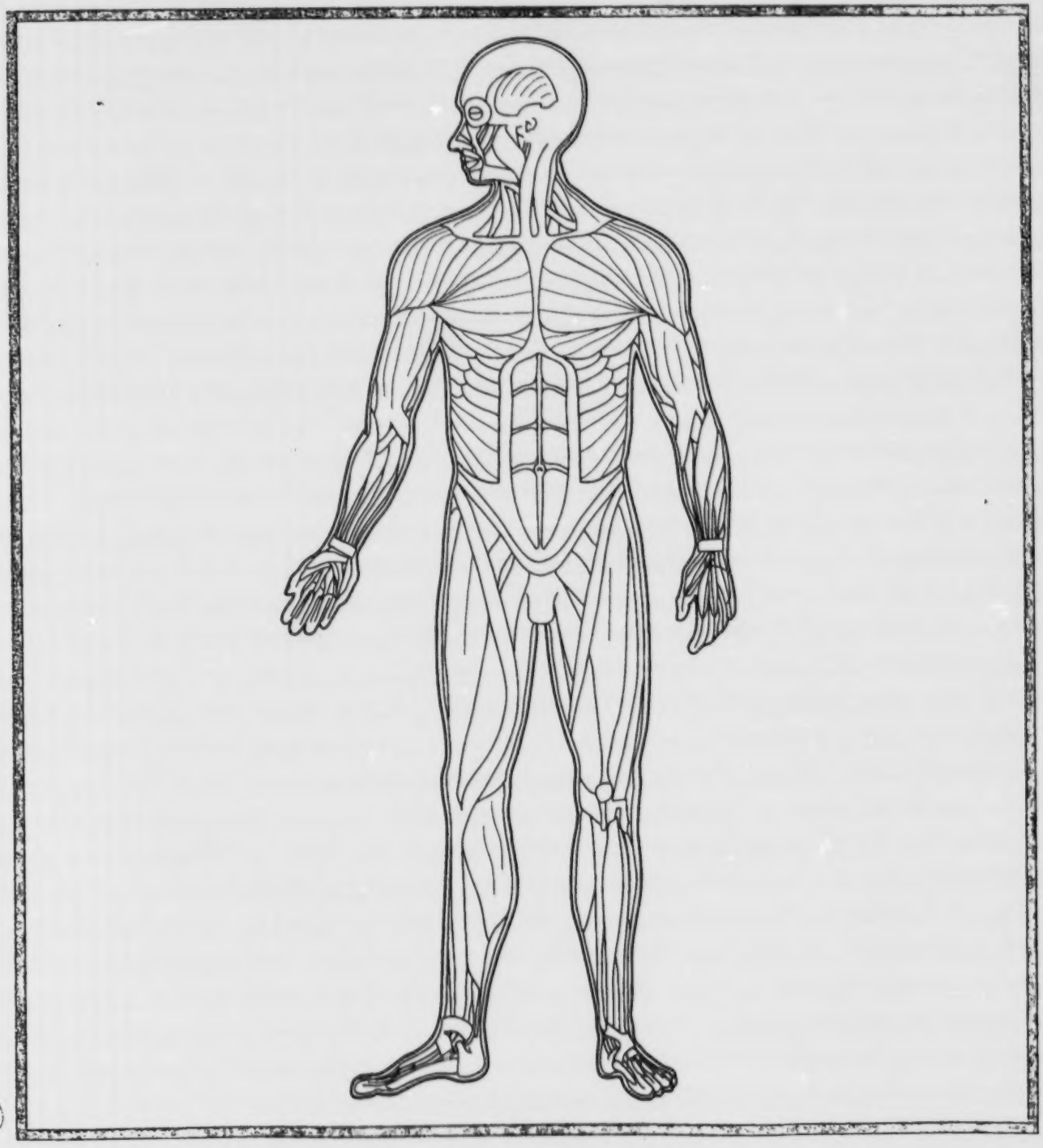
✔ **NOTE:** The following web site provides information specifically about the muscular system, though pages within the web site may provide information about other systems. If more general information about anatomy and physiology is desired, refer to the supplemental resources in the first four modules in Module Set I.

- http://www.ptcentral.com/muscles/index.html#muscles

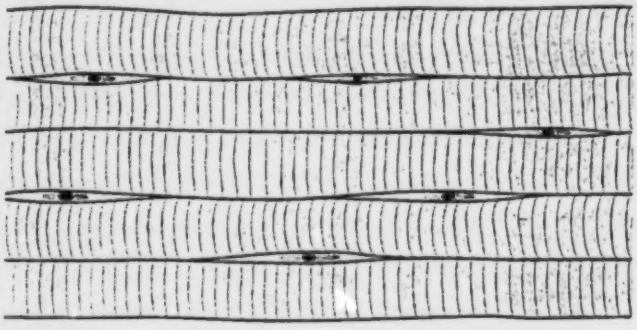
  This site provides an alphabetical listing of about 97 percent of all muscles. Clicking on the muscles and other links provides the student with detailed information about the muscles. The detail is more indepth than that provided in the module, and it will be useful to augment the student-edition presentation.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

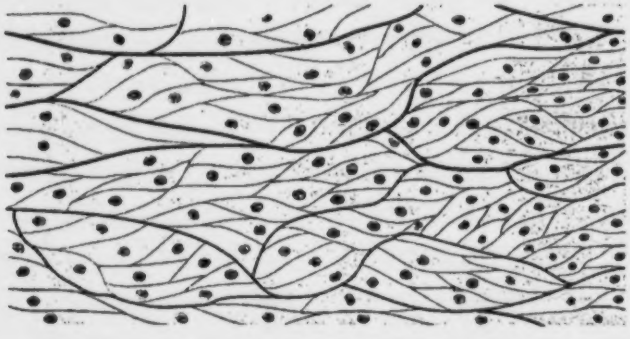
Muscular System



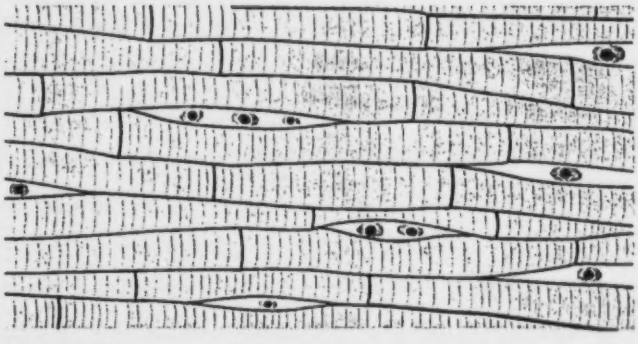
Major Classifications of Muscle Tissue



Skeletal muscle tissue (striated tissue)

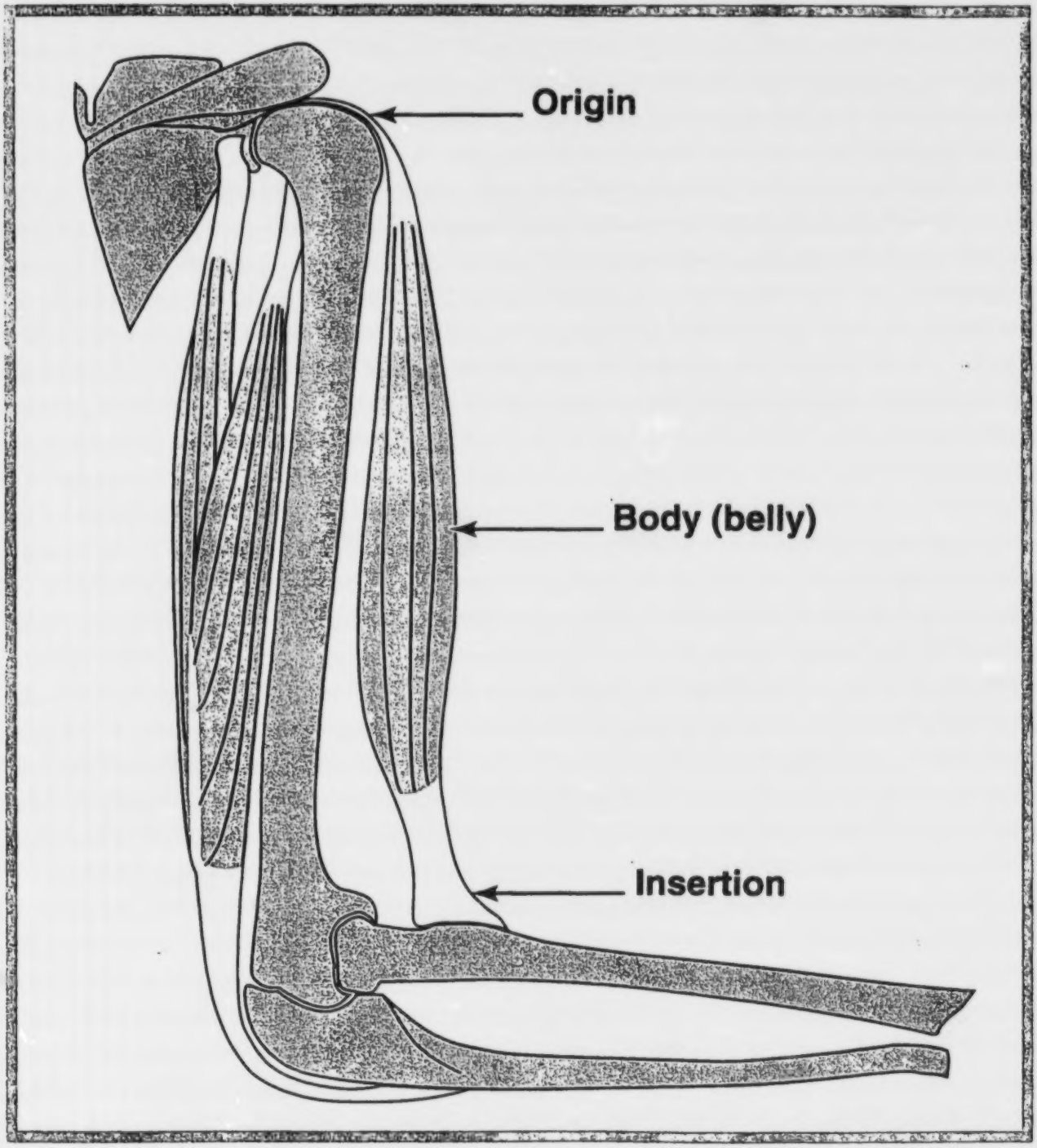


Visceral muscle tissue (smooth tissue)

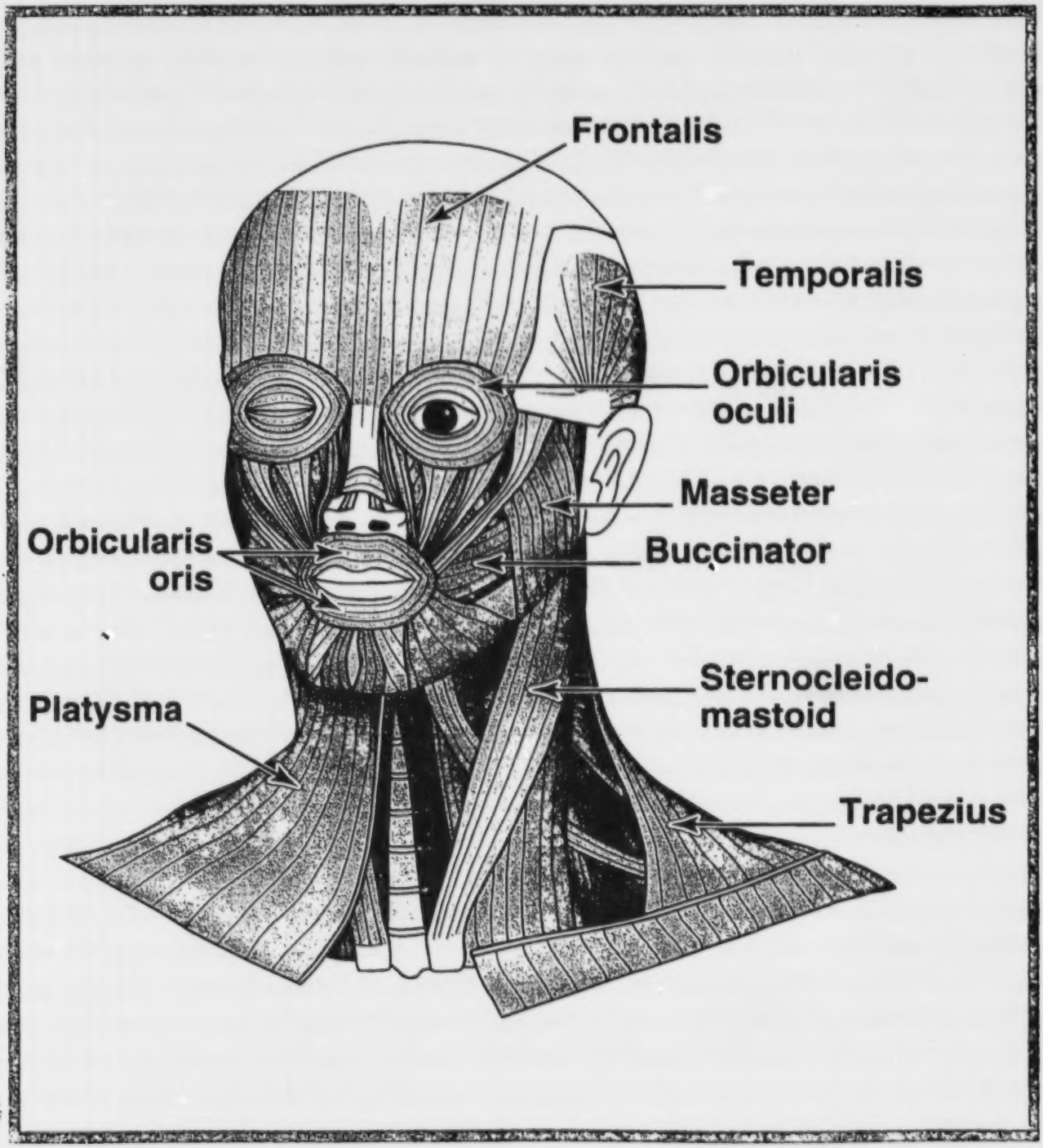


Cardiac muscle tissue (striated tissue)

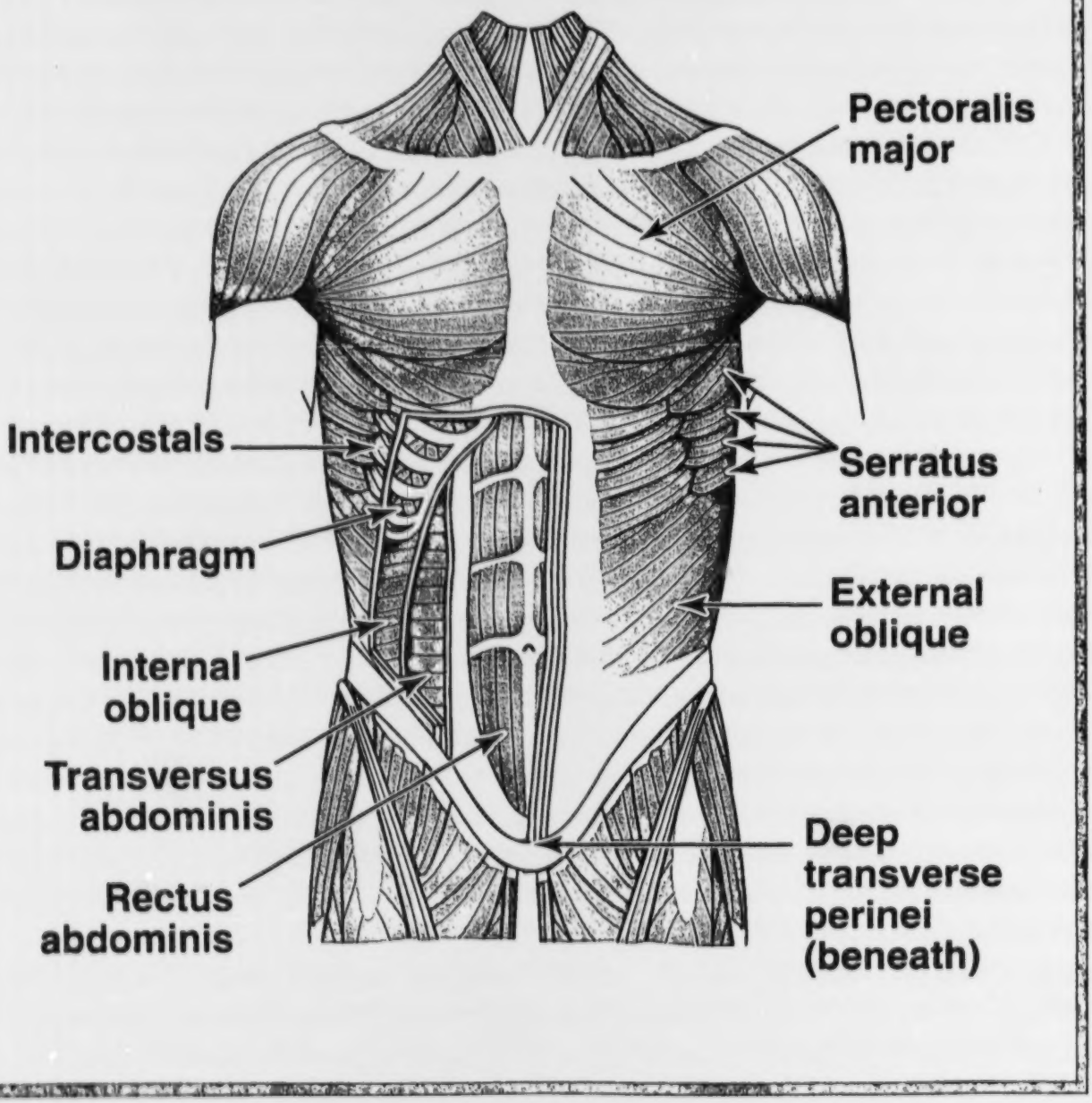
Major Structures of Skeletal Muscles



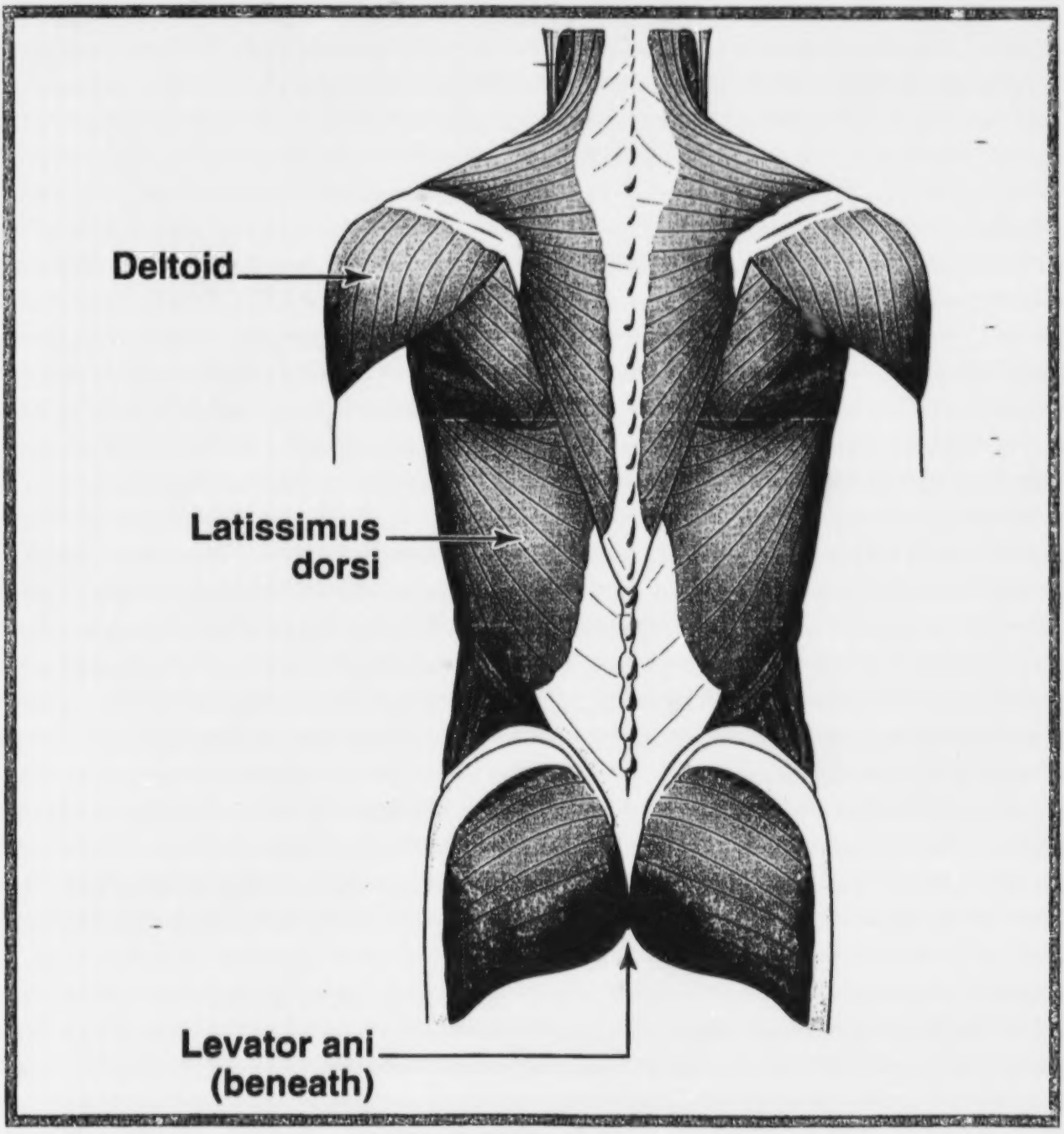
Major Muscles of the Neck, Head, and Face



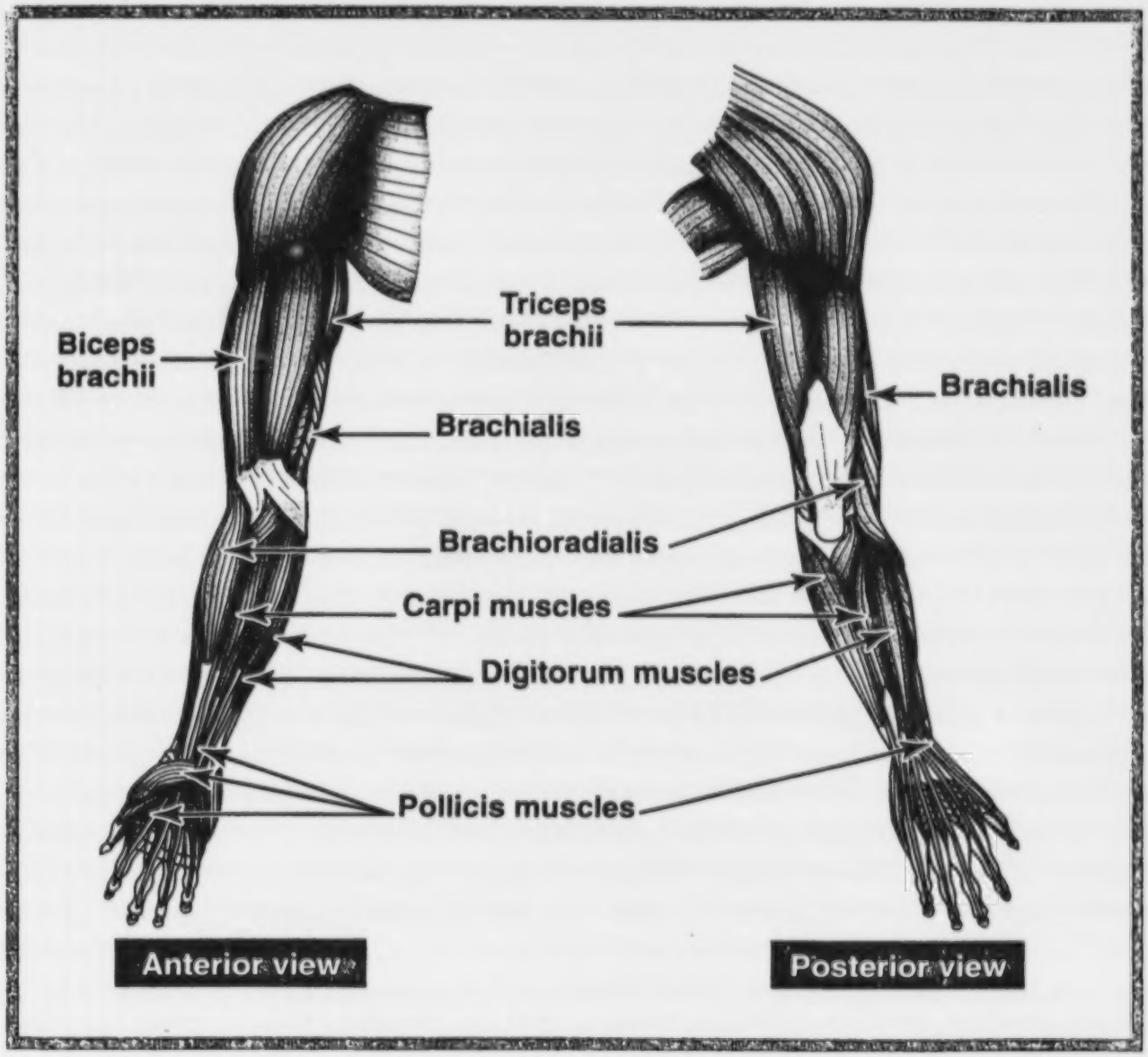
Major Muscles of the Torso (Anterior View)



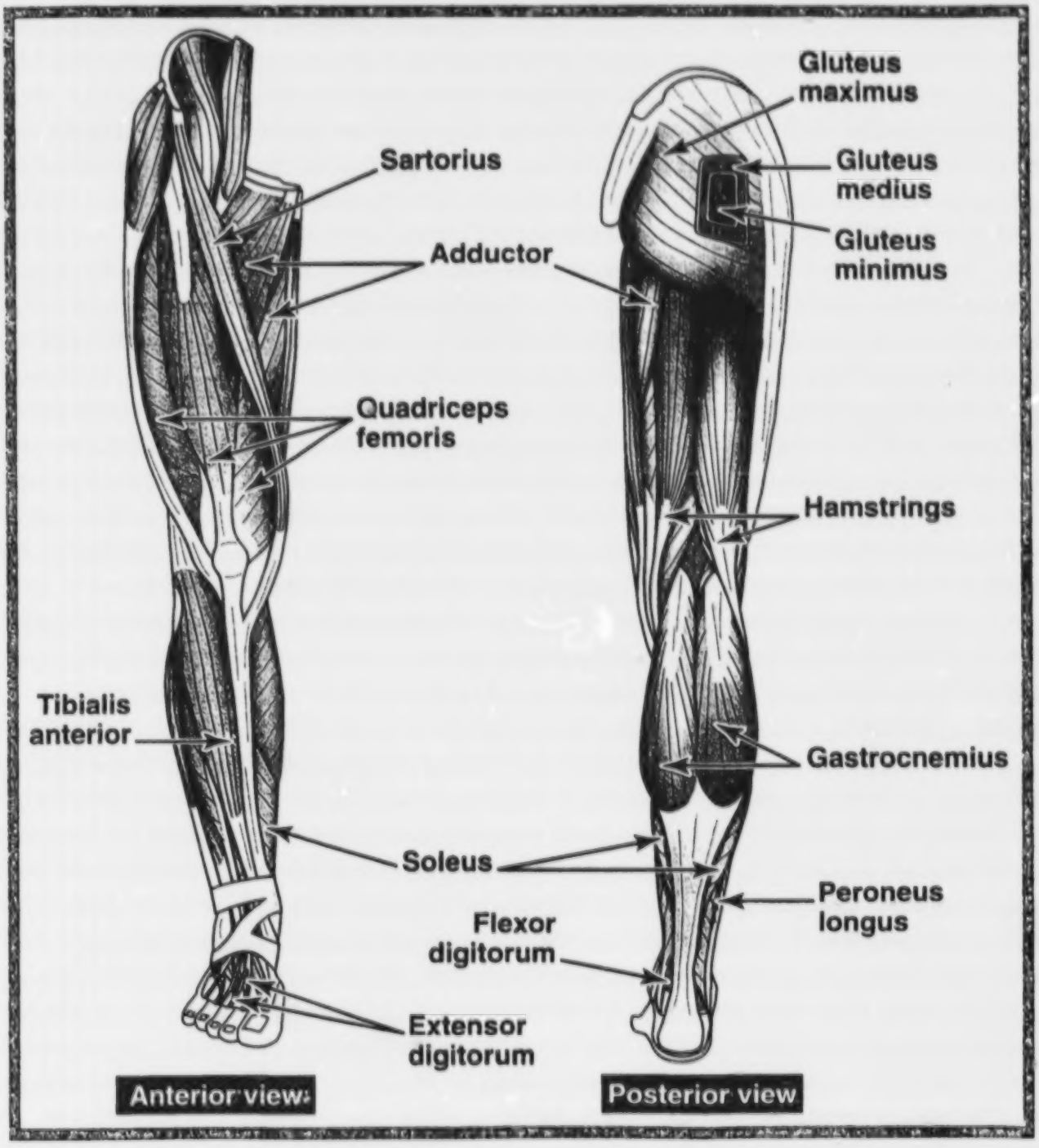
Major Muscles of the Torso (Posterior View)



Major Muscles of the Arms



Major Muscles of the Legs



Written Test

Name _____

Date _____ Score _____

OBJECTIVE 1 Define the term *muscular system*. Write your answer on the blank lines provided beside the term below.

Muscular system _____

_____

OBJECTIVE 2 State the functions of the muscular system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

OBJECTIVE 3 Describe the major classifications of muscle tissue. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Skeletal muscle tissue _____

_____

_____

_____

_____

b. Visceral muscle tissue _____

_____

_____

_____

_____

c. Cardiac muscle tissue _____

_____

_____

_____

_____

OBJECTIVE 4 Define the major structures of skeletal muscles. Write your answers on the blank lines provided beside each of the terms below.

a. Origin _____

_____

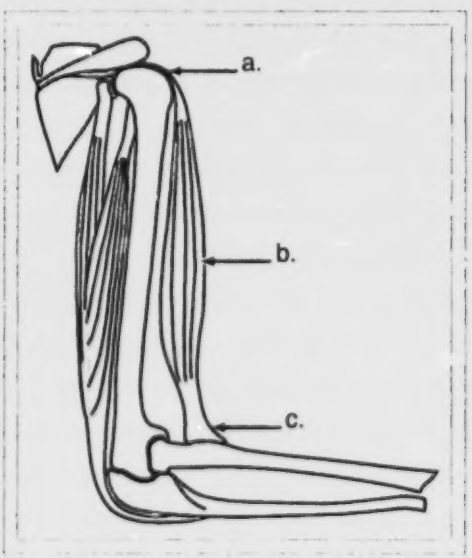
b. Insertion _____

_____

c. Body _____

_____

OBJECTIVE 5 Label the major structures of skeletal muscles. Write your answers on the blanks provided under the illustration below.



a. _____

b. _____

c. _____

Objective 6

Complete statements that describe the characteristics of the bone/muscle attachments of skeletal muscles. Write your answers on the blank lines provided in the statements below.

a. Skeletal muscles are enclosed in the _____, which is continuous with the fibrous structures that attach the muscles to bones and other structures.

b. Skeletal muscles are firmly attached to the structures on which they pull during _____.

c. Skeletal muscles may be attached directly to the _____ of a bone or may be attached by _____ or _____.

Objective 7

Complete statements that describe how skeletal muscles function. Write your answers on the blank lines provided in the statements below.

a. Muscles contract in response to electrical impulses, either the _____ stimulus of a motor-nerve impulse or an _____ stimulus such as electrical shock.

b. Muscles that move a body part usually lie _____ to the part that they move.

c. Locomotion of the body is caused by muscles pulling on _____.

d. _____ result from coordinated actions in pairs of muscles.

e. The coordinated actions of a pair of muscles generally mean that one muscle _____ while the other _____.

f. Normal movements of body parts are the result of the coordinated motion of several _____ of muscles.

g. The energy to produce movement in muscles is released from _____ through metabolism.

Objective 8

Define terms that describe the functional characteristics of muscle tissue. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Irritability _____

_____

b. Conductivity _____

c. Extensibility _____

d. Elasticity _____

e. Contractility _____

f. Tone _____

OBJECTIVE 9 State the actions performed by the types of muscles as classified by their actions. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Abductor _____

b. Adductor _____

c. Levator _____

d. Depressor _____

e. Flexor _____

f. Extensor _____

g. Rotator _____

h. Protractor _____

i. Retractor _____

_____

j. Invertor _____

_____

k. Evertor _____

_____

l. Supinator _____

_____

m. Pronator _____

_____

n. Dorsiflexor _____

_____

o. Sphincter _____

_____

p. Tensor _____

_____

OBJECTIVE 10

Define terms that describe how muscles function during coordinated movement. Write your answers on the blank lines provided beside each of the terms below.

a. Prime-mover muscle _____

_____

b. Agonist _____

_____

c. Antagonist _____

_____

d. Synergist _____

_____

e. Fixator _____

_____

OBJECTIVE 11

State the functions of the major muscle groups. Write your answers on the blank lines provided beside each of the terms below.

a. Head and face muscles _____

_____

b. Neck muscles _____

_____

c. Back muscles _____

_____

d. Chest muscles _____

_____

e. Abdominal muscles _____

_____

f. Perineal muscles _____

_____

OBJECTIVE 12

State the functions of the major muscles of the neck, head, and face. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Frontalis _____

_____

b. Temporalis _____

_____

c. Orbicularis oculi _____

_____

d. Orbicularis oris _____

_____

e. Buccinator _____

_____

f. Masseter _____

_____

g. Trapezius _____

_____

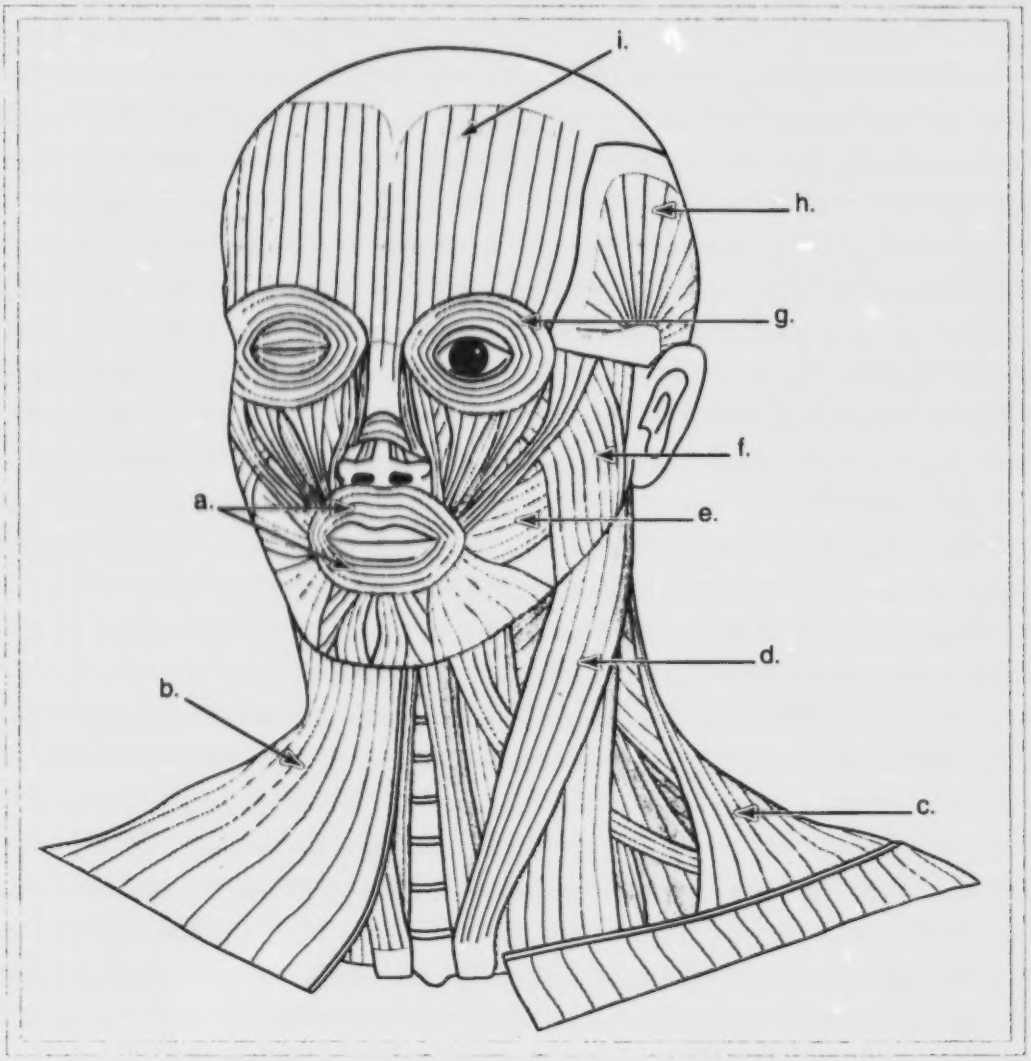
h. Sternocleidomastoid _____

_____

i. Platysma _____

_____

OBJECTIVE 13 Label the major muscles of the neck, head, and face. Write your answers on the blanks provided under the illustration below.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____

OBJECTIVE 14

State the functions of the major muscles of the torso. Write your answers on the blank lines provided beside each of the terms below.

a. Deltoid _____

b. Pectoralis major _____

c. Serratus anterior _____

d. Intercostals _____

e. Latissimus dorsi _____

f. Diaphragm _____

g. External oblique _____

h. Internal oblique _____

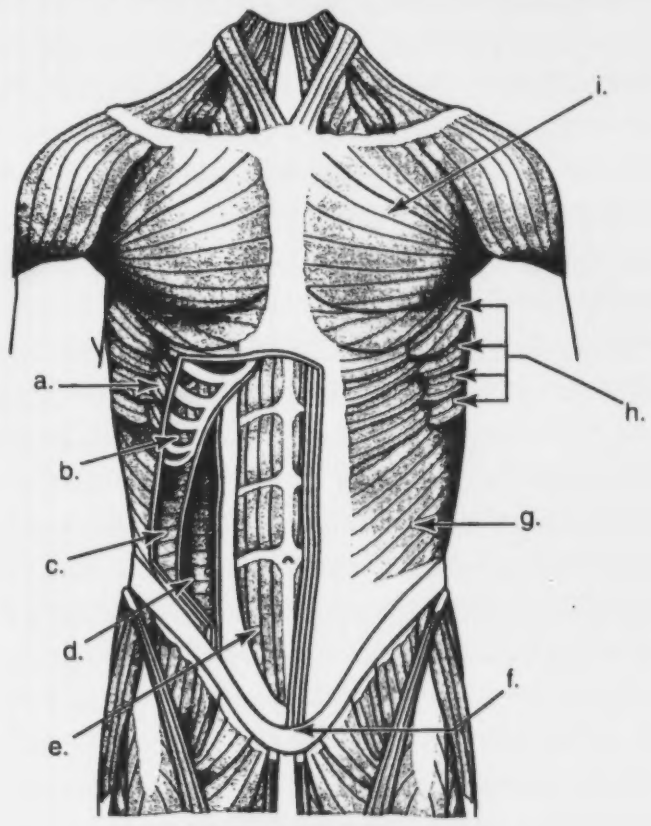
i. Transversus abdominis _____

j. Rectus abdominis _____

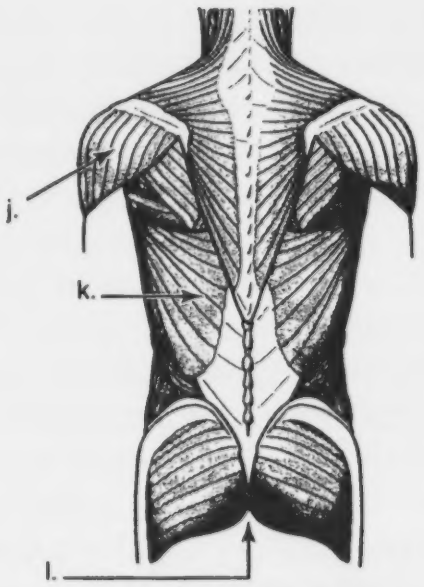
k. Levator ani _____

l. Deep transverse perinei _____

Objective 15 Label the major muscles of the torso. Write your answers on the blanks provided under the illustration below.



Anterior view



Posterior view

a. _____ g. _____

b. _____ h. _____

c. _____ i. _____

d. _____ j. _____

e. _____ k. _____

f. _____ l. _____

OBJECTIVE 16

State the functions of the major muscles of the arms. Write your answers on the blank lines provided beside each of the terms below.

a. Biceps brachii _____

b. Triceps brachii _____

c. Brachialis _____

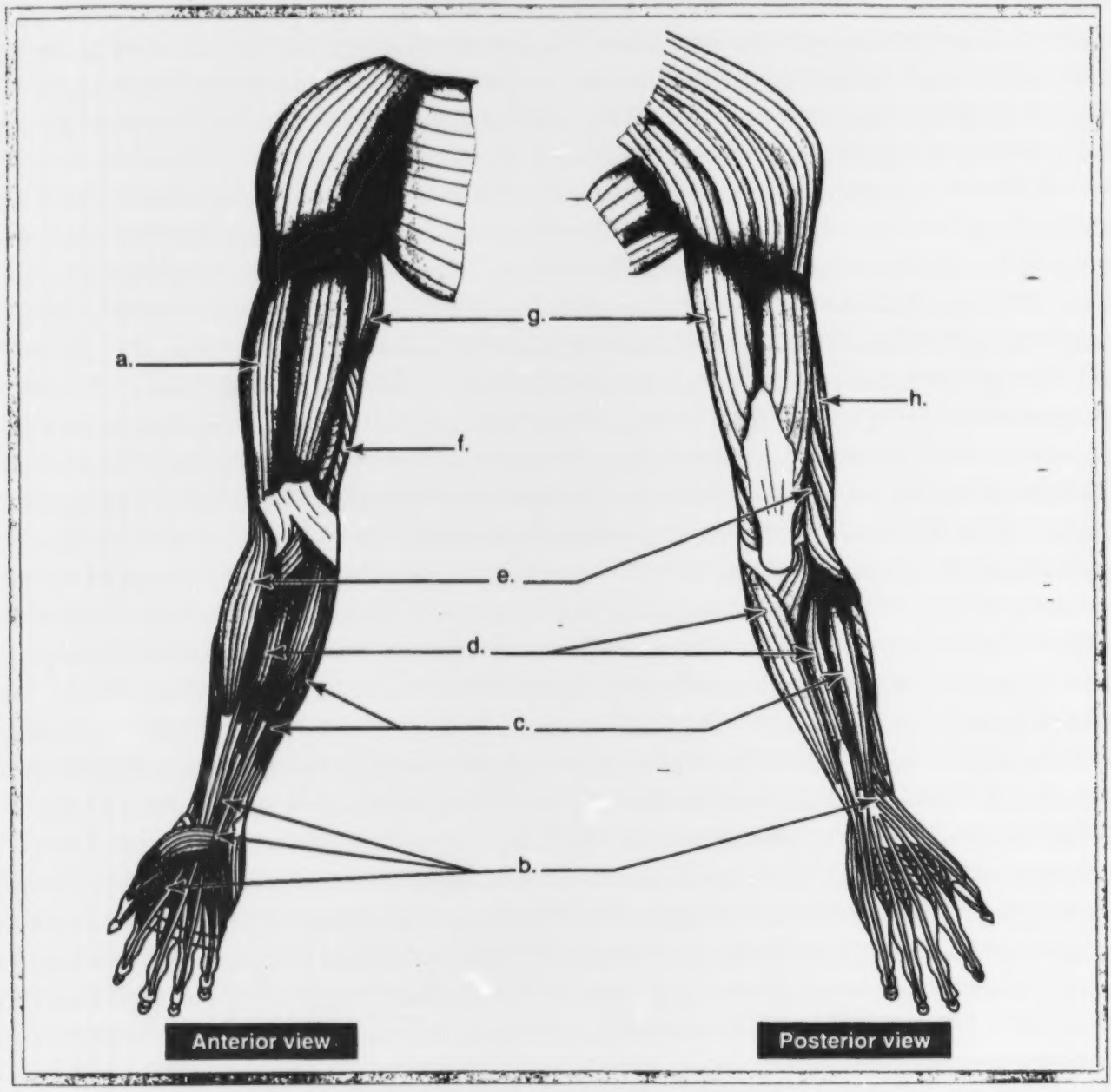
d. Brachioradialis _____

e. Carpi muscles _____

f. Digitorum muscles _____

g. Pollicis muscles _____

Objective 17 | Label the major muscles of the arms. Write your answers on the blanks provided under the illustration below.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____ h. _____

Objective 18

State the functions of the major muscles of the legs. Write your answers on the blank lines provided beside each of the terms below.

a. Gluteus maximus _____

_____

b. Gluteus medius _____

_____

c. Gluteus minimus _____

_____

d. Sartorius _____

_____

e. Quadriceps femoris _____

_____

f. Adductor _____

_____

g. Hamstring _____

_____

h. Gastrocnemius _____

_____

i. Tibialis anterior _____

_____

j. Peroneus longus _____

_____

k. Soleus _____

_____

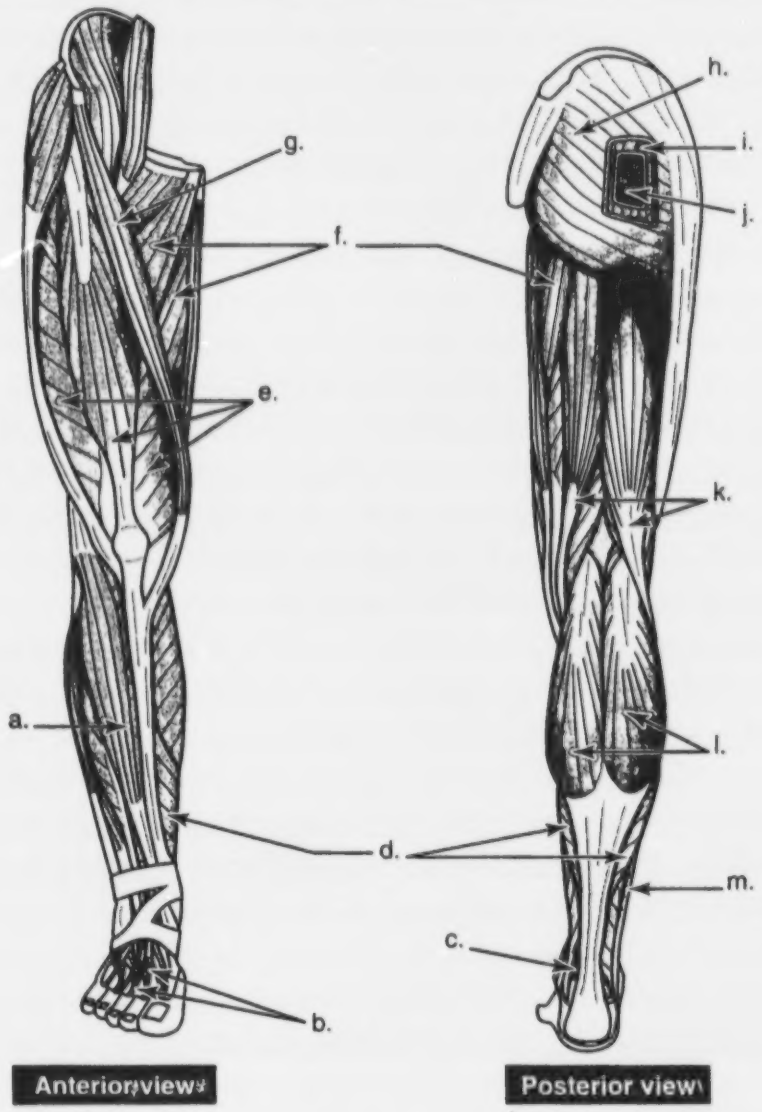
l. Flexor digitorum _____

_____

m. Extensor digitorum _____

_____

OBJECTIVE 19 Label the major muscles of the legs. Write your answers on the blanks provided under the illustration below.



a. _____ f. _____ k. _____

b. _____ g. _____ l. _____

c. _____ h. _____ m. _____

d. _____ i. _____

e. _____ j. _____

OBJECTIVE 20

Match common disorders and abnormalities of the muscular system to their correct definitions. Write the numbers on the blanks provided.

_____ a. Localized internal bleeding within a muscle

_____ b. Muscle pain

_____ c. An asynchronous contraction of individual tissue fibers within a muscle

_____ d. An inflammation of muscle tissue

_____ e. An inflammation of the tendon sheath often caused by repetitive motion

_____ f. An infection by an organism that releases a toxin that prevents muscle contraction

_____ g. A condition in which the muscle fibers have been overstretched or torn

_____ h. A protrusion of an abdominal organ, such as the small intestine, due to a weakness in the abdominal muscles

_____ i. The inability of the muscles to relax due to the presence of a toxin

_____ j. Painful, involuntary twitches of a muscle

_____ k. An autoimmune disease in which the immune system attacks muscle cells at the neuro-muscular junction

_____ l. A group of genetic diseases that lead to atrophy of the skeletal muscles

_____ m. A condition of weakness in a muscle due to lack of use

_____ n. An inflammation of a tendon

_____ o. Abnormal, uncoordinated contractions of muscles

1. Atrophy
2. Botulism
3. Contusion
4. Convulsions
5. Cramps
6. Fibrillation
7. Fibromyositis
8. Hernia
9. Muscular dystrophy
10. Myalgia
11. Myasthenia gravis
12. Myositis
13. Strain
14. Tenosynovitis
15. Tetanus

Answers to Written Test

Objective 1

All of the muscles of the body considered as an interrelated structural group

Objective 2

Answers may appear in any order.

a. Assists in body movements
b. Assists in the movement of materials internal to the body
c. Produces heat and energy
d. Assists in maintaining posture and balance
e. Helps to protect the internal organs

Objective 3

Descriptions should include the following.

a. Skeletal muscle tissue is voluntary; is striated, consisting of long slender, striped cells; is attached to the skeleton and moves the skeleton's moving parts, acting in opposing groups with some muscles relaxing and some contracting; and contracts quickly in response to stimulation of nerve impulses.

b. Visceral muscle tissue is involuntary; is non-striated, consisting of spindle-shaped cells; is found in the viscera, especially the stomach, intestines, urinary ducts, and blood vessels; and contracts slowly in response to stimulation to nerve impulses.

c. Cardiac muscle tissue is involuntary; is partially striated; is found only in the heart; and contracts moderately fast in response to stimulation to nerve impulses.

Objective 4

a. The less-movable end of a skeletal-muscle attachment that is closer to the midline of the trunk of the body and is attached to the less-movable end of the bone

b. The end of a skeletal-muscle attachment that is attached to the more-movable bone

c. The largest or the main part of a skeletal muscle

Objective 5

a. Origin
b. Body (belly)
c. Insertion

Objective 6

a. epimysium
b. contraction
c. periosteum; tendons; aponeuroses

Objective 7

a. natural; artificial
b. proximal
c. bones
d. Body movements
e. contracts; relaxes
f. pairs
g. simple sugars

Objective 8

a. The ability to respond to stimuli

b. The ability to transmit impulses

c. The ability to stretch (lengthen) and remain stretched (hold)

d. The ability to return to a former length when the stretching force is removed

e. The ability to contract or shorten

f. The slight tension that is present in muscles even when they are at rest so that they can respond more easily and quickly when needed

Objective 9

a. Performs abduction, moving away from a part or a midline

b. Performs adduction, moving toward a part or toward a midline

c. Performs elevation, lifting a part

d. Performs depression, lowering a part

e. Performs flexion, bending a part at a joint

f. Performs extension, straightening a part at a joint

g. Performs medial rotation—revolving a part on its axis—or lateral rotation—moving a part so that its distal point travels in a circle

h. Performs protraction, moving a part forward

i. Performs retraction, moving a part back

j. Performs inversion, turning a part upside down or inside out

k. Performs eversion, turning or rotating a part outward

l. Performs supination, turning a part upward

m. Performs pronation, turning a part downward

n. Performs dorsiflexion, moving a part toward the back

o. Performs constriction, closing a body opening

p. Performs tension, making a part more rigid

Objective 10

a. A muscle that generates the majority of force to accomplish a movement

b. A muscle or group of muscles that create a specific movement by flexing

c. A muscle or group of muscles that, when flexed, directly oppose prime-mover muscles

d. A muscle or group of muscles that assist in the movement produced by prime-mover muscles

e. A muscle or group of muscles that stabilize a joint, helping to maintain posture and balance during the action of prime-mover muscles

Objective 11

a. Control talking, chewing, swallowing, facial expressions, and blinking

b. Move the head from side to side, from front to back, and in rotation

c. Allow the body to bend, turn, and stand erect

d. Assist in respiration and movements of the neck, arms, and trunk

e. Support the internal organs, assist in respiration, and assist in eliminating waste from the large intestine and bladder

f. Assist in defecation and urination and form the floor of the pelvic cavity

Objective 12

a. Wrinkles the forehead horizontally

b. Closes the mandible

c. Closes the eyelids

d. Draws the lips together as in kissing

e. Moves the lips for blowing, whistling, and smiling

f. Closes the jaws as in chewing

g. Moves the shoulders by raising, assists in moving the head to one side or the other, hyperextends the head when the occiput acts as insertion, and helps hold the head erect

h. Rotates the head from side to side, flexes the upper vertebral column and head as in bowing the head, and helps hold the head erect

i. Acts to wrinkle the skin in the neck and depresses the mandible

Objective 13

a. Orbicularis oris
b. Platysma
c. Trapezius
d. Sternocleidomastoid
e. Buccinator
f. Masseter
g. Orbicularis oculi
h. Temporalis
i. Frontalis

Objective 14

a. Moves the upper arm at the point of the shoulder

b. Flexes the upper arm, adducts the upper arm anteriorly, and draws the arm across the chest

c. Rotates the scapula and raises the shoulder, as in full flexion and abduction of the arm

d. Elevate and depress the ribs

e. Brings the arms down forcefully

f. Contracts and relaxes to cause inhalation and exhalation

g. Compresses the abdomen and rotates the trunk laterally

h. Compresses the abdomen and rotates the trunk laterally

i. Compresses the abdomen and rotates the trunk laterally

j. Compresses the abdomen and rotates the trunk laterally and flexes the trunk

k. Forms the floor of the pelvic cavity and supports the organs

l. Forms the floor of the pelvic cavity

Objective 15

a. Intercostals
b. Diaphragm
c. Internal oblique
d. Transversus abdominis
e. Rectus abdominis
f. Deep transverse perinei
g. External oblique
h. Serratus anterior
i. Pectoralis major
j. Deltoid
k. Latissimus dorsi
l. Levator ani

Objective 16

a. Flexes the supinated forearm
b. Extends the lower arm
c. Flexes the pronated forearm
d. Flexes the forearm
e. Control hand movements
f. Control finger movements
g. Control thumb movements

Objective 17

a. Biceps brachii
b. Pollicis muscles
c. Digitorum muscles
d. Carpi muscles
e. Brachioradialis
f. Brachialis
g. Triceps brachii
h. Brachialis

Objective 18

a. Helps maintain an erect posture and extends and rotates the thigh

b. Abducts the thigh, rotates the thigh outward, and stabilizes the pelvis on the femur

c. Abducts the thigh, rotates the thigh outward, stabilizes the pelvis on the femur, and extends the thigh

d. Adducts and flexes the leg

e. Extends the leg

f. Presses the thighs together

g. Flexes the lower leg

h. Extends the foot

i. Flexes the foot and inverts the ankle

j. Everts the ankle

k. Inverts the ankle

l. Flexes the toes

m. Extends the toes

Objective 19

a. Tibialis anterior
b. Extensor digitorum
c. Flexor digitorum
d. Soleus
e. Quadriceps femoris
f. Adductor
g. Sartorius
h. Gluteus maximus
i. Gluteus medius
j. Gluteus minimus
k. Hamstrings
l. Gastrocnemius
m. Peroneus longus

Objective 20

a. 3	d. 12	g. 13	j. 5	m. 1
b. 10	e. 14	h. 8	k. 11	n. 7
c. 6	f. 2	i. 15	l. 9	o. 4

Answers to Assignment Sheets

Assignment Sheet 1

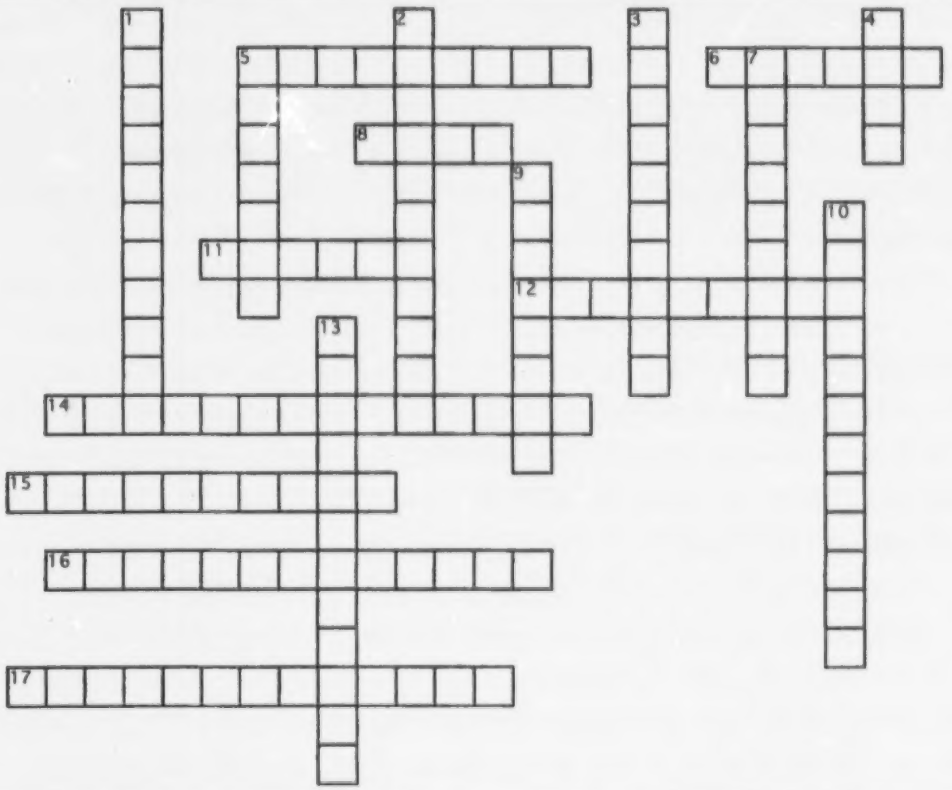
Answers will vary and must be evaluated to the satisfaction of the instructor.

Assignment Sheet 2

Answers will vary and must be evaluated to the satisfaction of the instructor.

Crossword Puzzle 1—Terms from Objectives 1 Through 8

Name _____ Date _____



ACROSS

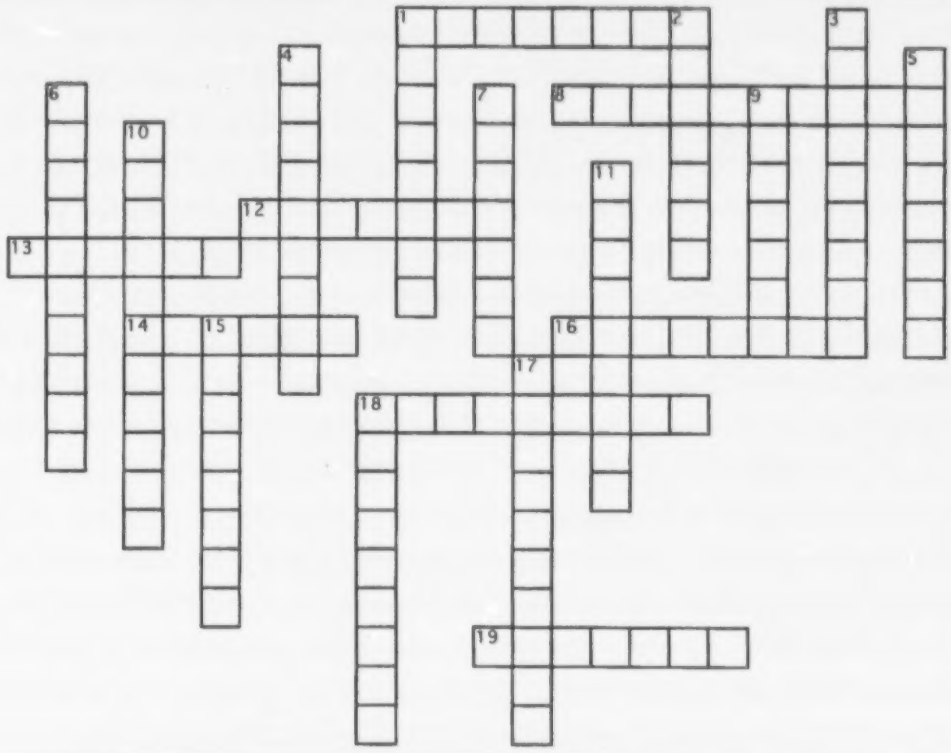
5. Functioning under the conscious control of the organism
6. A structure in which the epimysium extends from the muscle as a broad, flat sheet of connective tissue that attaches to an adjacent structure; one of many white, glistening fibrous bands of tissue that attach muscle to bone
8. The largest or the main part of a skeletal muscle
11. The less-movable end of a skeletal-muscle attachment that is closer to the midline of the trunk of the body and is attached to the less-movable end of the bone
12. The end of a skeletal-muscle attachment that is attached to the more-movable bone
14. All of the muscles of the body considered as an interrelated structural group (2 words)
15. A functional characteristic of muscle tissue—the ability to return to a former length when the stretching force is removed
16. A functional characteristic of muscle tissue—the ability to stretch (lengthen) and remain stretched (hold)
17. A functional characteristic of muscle tissue—the ability to contract or shorten

DOWN

1. A structure in which the epimysium extends from the muscle as a strong, tough cord of connective tissue that is continuous with the periosteum of the bone; a strong sheet of fibrous connective tissue that serves as a tendon to attach muscles to bone or as fascia to bind muscles together
2. Functioning without the conscious control of the organism
3. A fibrous, vascular membrane covering the bones, except at their extremities
4. A functional characteristic of muscle tissue—the slight tension that is present in muscles even when they are at rest so that they can respond more easily and quickly when needed
5. The internal organs in the abdominal cavity
7. A fibrous sheath that enfolds a skeletal muscle and extends over the origin and insertion and between bundles of muscle fibers
9. Consisting of narrow bands or rows
10. A functional characteristic of muscle tissue—the ability to transmit impulses
13. A functional characteristic of muscle tissue—the ability to respond to stimuli

Crossword Puzzle 2—Terms from Objectives 9 and 10

Name _____ Date _____



ACROSS

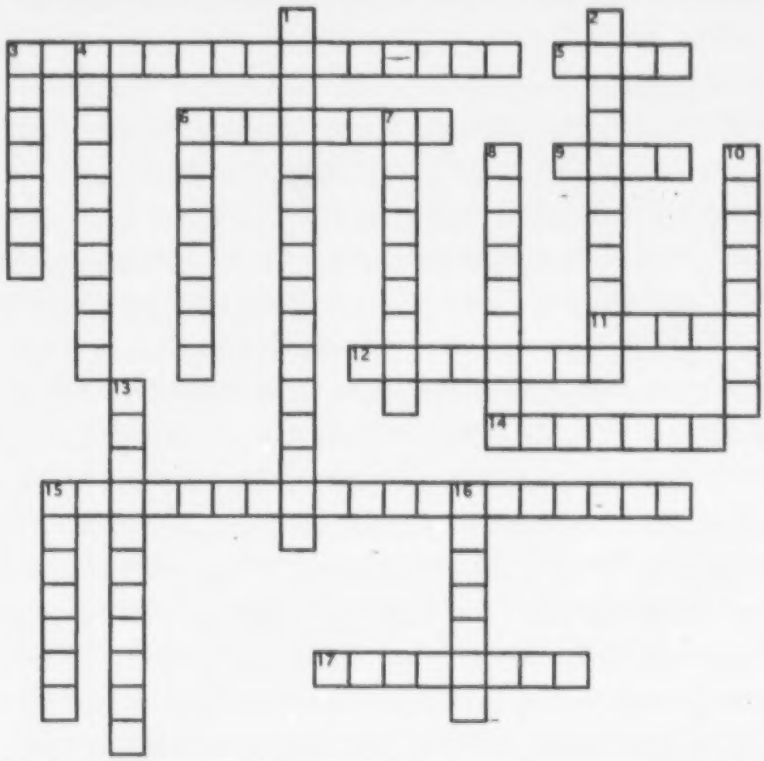
1. A muscle that causes an action moving away from a part or a midline
8. A muscle that causes an action that moves a part forward
12. A muscle that causes an action that lifts a part
13. A muscle that causes an action that makes a part more rigid
14. A muscle that causes an action that bends a part at a joint
16. A muscle that causes an action that turns a part upside down or inside out
18. A muscle that causes an action that closes a body opening
19. A muscle or group of muscles that stabilize a joint, helping to maintain posture and balance during the action of prime-mover muscles

DOWN

1. A muscle that causes an action moving toward a part or toward a midline
2. A muscle that causes an action that revolves a part on its axis or that moves a part so that its distal point travels in a circle
3. A muscle that causes an action that moves a part back
4. A muscle that causes an action that lowers a part
5. A muscle that causes an action that turns a part downward
6. A muscle that generates the majority of force to accomplish a movement (2 words)
7. A muscle that causes an action that turns or rotates a part outward
9. A muscle or group of muscles that create a specific movement by flexing
10. A muscle that causes an action that moves a part toward the back
11. A muscle that causes an action that turns a part upward
15. A muscle that causes an action that straightens a part at a joint
17. A muscle or group of muscles that, when flexed, directly oppose prime-mover muscles
18. A muscle or group of muscles that assist in the movement produced by prime-mover muscles

Crossword Puzzle 3—Terms from Objectives 11 Through 13

Name _____ Date _____



ACROSS

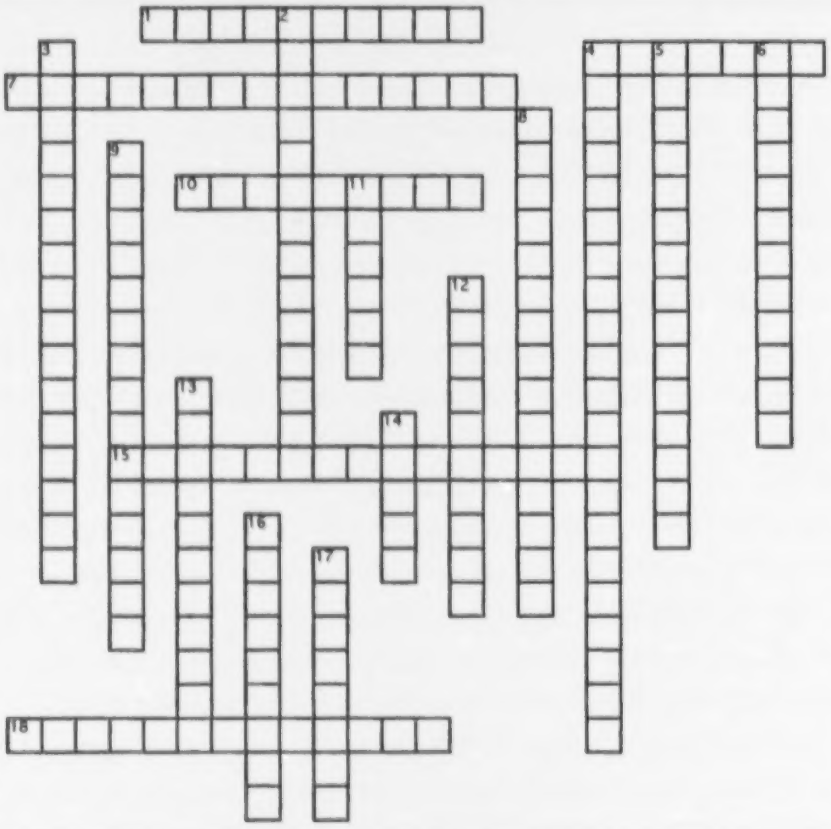
3. The muscle that draws the lips together as in kissing (2 words)
5. The major muscle group that moves the head from side to side, from front to back, and in rotation
6. The major muscle group that assists in defecation and urination and forms the floor of the pelvic cavity
9. The major muscle group that allows the body to bend, turn, and stand erect
11. The major muscle group that assists in respiration and movements of the neck, arms, and trunk
12. The lower jawbone
14. The shoulder blade
15. The muscle that rotates the head from side to side, flexes the upper vertebral column and head as in bowing the head, and helps hold the head erect
17. The collarbone

DOWN

1. The muscle that closes the eyelids (2 words)
2. The major muscle group that controls talking, chewing, swallowing, facial expressions, and blinking (3 words)
3. The back of the head
4. The muscle that moves the lips for blowing, whistling, and smiling
6. The muscle that acts to wrinkle skin in the neck and depresses the mandible
7. The major muscle group that supports the internal organs, assists in respiration, and assists in eliminating waste from the large intestine and bladder
8. The muscle that moves the shoulders by raising, assists in moving the head to one side or the other, hyperextends the head when the occiput acts as insertion, and helps hold the head erect
10. The muscle that closes the jaws as in chewing
13. To extend to its fullest range of motion or beyond
15. The breastbone
16. The process of the temporal bone behind the ear

Crossword Puzzle 4—Terms from Objectives 14 Through 17

Name _____ Date _____



ACROSS

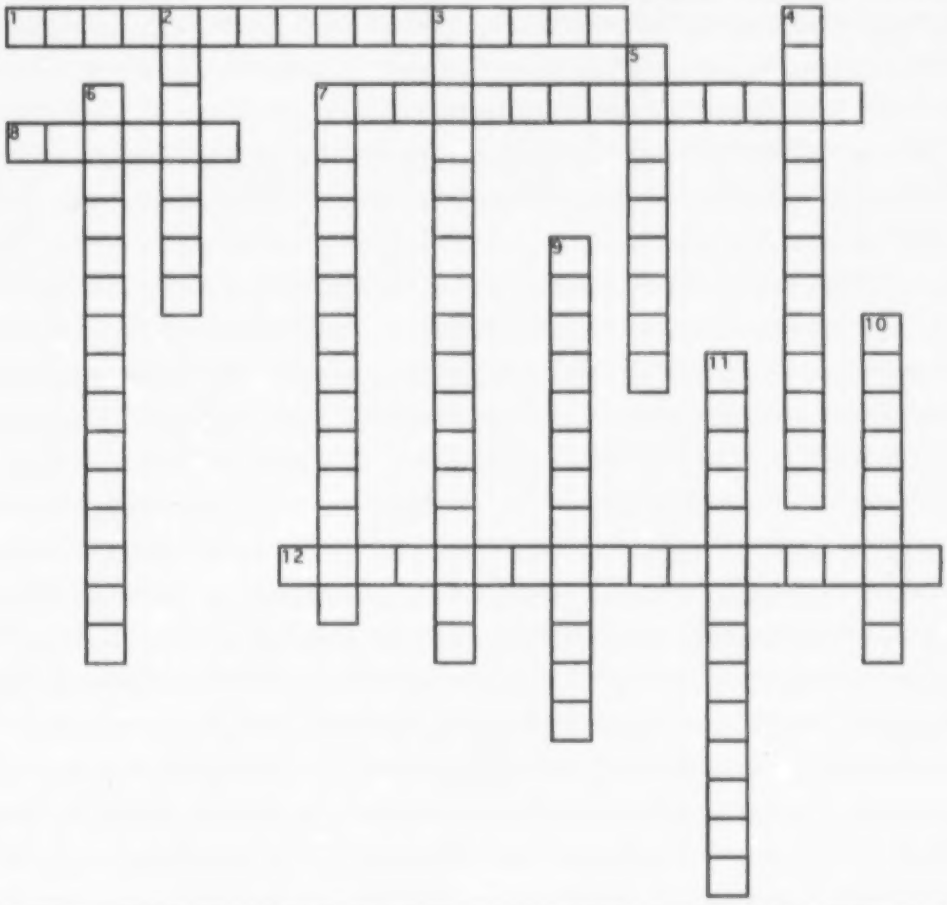
1. Major muscle of the torso that forms the floor of the pelvic cavity and supports the organs (2 words)
4. Major muscle of the torso that moves the upper arm at the point of the shoulder
7. Major muscle of the torso that flexes the upper arm, adducts the upper arm anteriorly, and draws the arm across the chest (2 words)
10. Major muscle of the torso that contracts and relaxes to cause inhalation and exhalation
15. Major muscle of the arms that flexes the forearm
18. Major muscle of the arms that flexes the supinated forearm (2 words)

DOWN

2. Major muscle of the arms that extends the lower arm (2 words)
3. Major muscle of the torso that rotates the scapula and raises the shoulder, as in full flexion and abduction of the arm (2 words)
4. Major muscle of the torso that forms the floor of the pelvic cavity (3 words)
5. Major muscle of the torso that brings the arms down forcefully (2 words)
6. Major muscles of the torso that elevate and depress the ribs
8. Major muscle of the torso that compresses the abdomen and rotates the trunk laterally (2 words)
9. Major muscle of the torso that compresses the abdomen and rotates the trunk laterally (2 words)
11. Major muscle of the torso that compresses the abdomen and rotates the trunk laterally and flexes the trunk is called _____ *abdominis*
12. Major muscle of the arms that flexes the pronated forearm
13. Major muscle of the torso that compresses the abdomen and rotates the trunk laterally is called _____ *abdominis*
14. Major muscles of the arms that control hand movements are called _____ *muscles*
16. Major muscles of the arms that control finger movements are called _____ *muscles*
17. Major muscles of the arms that control thumb movements are called _____ *muscles*

Crossword Puzzle 5—Terms from Objectives 18 and 19

Name _____ Date _____



ACROSS

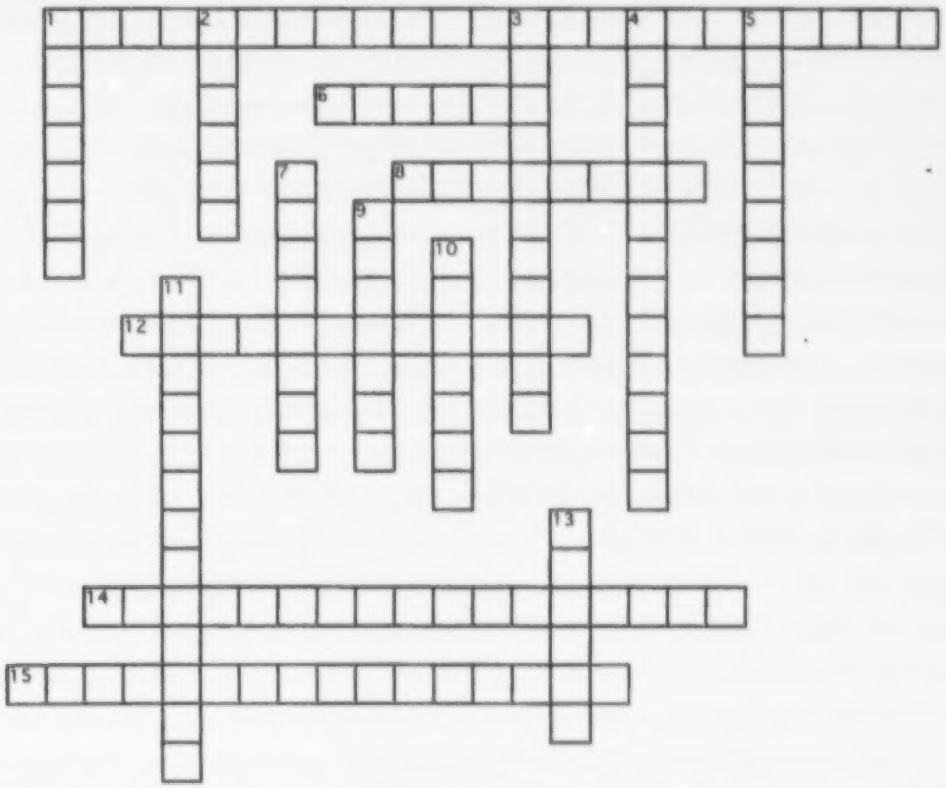
1. Major muscle of the legs that flexes the foot and inverts the ankle (2 words)
7. Major muscle of the legs that helps maintain an erect posture and extends and rotates the thigh (2 words)
8. Major muscle of the legs that inverts the ankle
12. Major muscle of the legs that extends the leg (2 words)

DOWN

2. Major muscle of the legs that presses the thighs together
3. Major muscle of the legs that extends the toes (2 words)
4. Major muscle of the legs that abducts the thigh, rotates the thigh outward, and stabilizes the pelvis on the femur (2 words)
5. Major muscle of the legs that adducts and flexes the leg
6. Major muscle of the legs that flexes the toes (2 words)
7. Major muscle of the legs that abducts the thigh, rotates the thigh outward, stabilizes the pelvis on the femur, and extends the thigh (2 words)
9. Major muscle of the legs that extends the foot
10. Major muscle of the legs that flexes the lower leg
11. Major muscle of the legs that everts the ankle (2 words)

Crossword Puzzle 6—Terms from Objective 20

Name _____ Date _____



ACROSS

1. The flexing of the muscles at unexpected or undesired times (2 words)
6. A condition in which the muscle fibers have been overstretched or torn
8. An infection by an organism that releases a toxin that prevents muscle contraction
12. An asynchronous contraction of individual tissue fibers within a muscle
14. A group of genetic diseases that lead to atrophy of the skeletal muscles (2 words)
15. An autoimmune disease in which the immune system attacks muscle cells at the neuromuscular junction (2 words)

DOWN

1. A condition of weakness in a muscle due to lack of use
2. Painful, involuntary twitches of a muscle
3. Abnormal, uncoordinated contractions of muscles
4. An inflammation of the tendon sheath often caused by repetitive motion
5. Localized internal bleeding within a muscle
7. An inflammation of muscle tissue
9. Muscle pain
10. The inability of the muscles to relax due to the presence of a toxin
11. An inflammation of a tendon
13. A protrusion of an abdominal organ, such as the small intestine, due to a weakness in the abdominal muscles

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
5. VOLUNTARY
6. TENDON
8. BODY
11. ORIGIN
12. INSERTION
14. MUSCULAR SYSTEM
15. ELASTICITY
16. EXTENSIBILITY
17. CONTRACTILITY

DOWN
1. APONEUROSIS
2. INVOLUNTARY
3. PERIOSTEUM
4. TONE
5. VISCERA
7. EPIMYSIUM
9. STRIATED
10. CONDUCTIVITY
13. IRRITABILITY

Crossword Puzzle 2

ACROSS
1. ABDUCTOR
8. PROTRACTOR
12. LEVATOR
13. TENSOR
14. FLEXOR
16. INVERTOR
18. SPHINCTER
19. FIXATOR

DOWN
1. ADDUCTOR
2. ROTATOR
3. RETRACTOR
4. DEPRESSOR
5. PRONATOR
6. PRIME MOVER
7. EVERTOR
9. AGONIST
10. DORSIFLEXOR
11. SUPINATOR
15. EXTENSOR
17. ANTAGONIST
18. SYNERGIST

Crossword Puzzle 3

ACROSS
3. ORBICULARIS ORIS
5. NECK
6. PERINEAL
9. BACK
11. CHEST
12. MANDIBLE
14. SCAPULA
15. STERNOCLEIDOMASTOID
17. CLAVICLE

DOWN
1. ORBICULARIS OCULI
2. HEAD AND FACE
3. OCCIPUT
4. BUCCINATOR
6. PLATYSMA
7. ABDOMINAL
8. TRAPEZIUS
10. MASSETER
13. HYPEREXTEND
15. STERNUM
16. MASTOID

Crossword Puzzle 4

ACROSS

1. LEVATOR ANI
4. DELTOID
7. PECTORALIS MAJOR
10. DIAPHRAGM
15. BRACHIORADIALIS
18. BICEPS BRACHII

DOWN

2. TRICEPS BRACHII
3. SERRATUS ANTERIOR
4. DEEP TRANSVERSE PERINEI
5. LATISSIMUS DORSI
6. INTERCOSTALS
8. EXTERNAL (or INTERNAL) OBLIQUE
9. INTERNAL (or EXTERNAL) OBLIQUE
11. RECTUS
12. BRACHIALIS
13. TRANSVERSUS
14. CARPI
16. DIGITORUM
17. POLLICIS

Crossword Puzzle 5

ACROSS

1. TIBIALIS ANTERIOR
7. GLUTEUS MAXIMUS
8. SOLEUS
12. QUADRICEPS FEMORIS

DOWN

2. ADDUCTOR
3. EXTENSOR DIGITORUM
4. GLUTEUS MEDIUS
5. SARTORIUS
6. FLEXOR DIGITORUM
7. GLUTEUS MINIMUS
9. GASTROCNEMIUS
10. HAMSTRING
11. PERONEUS LONGUS

Crossword Puzzle 6

ACROSS

1. ASYNCHRONOUS CONTRACTION
6. STRAIN
8. BOTULISM
12. FIBRILLATION
14. MUSCULAR DYSTROPHY
15. MYASTHENIA GRAVIS

DOWN

1. ATROPHY
2. CRAMPS
3. CONVULSIONS
4. TENOSYNOVITIS
5. CONTUSION
7. MYOSITIS
9. MYALGIA
10. TETANUS
11. FIBROMYOSITIS
13. HERNIA

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 12

1. The back of the head is called the _____.

   a. *clavicle*
   b. *scapula*
   c. *occiput*
   d. *mastoid process*

Objective 7

2. The energy to produce movement in muscles is released from _____.

   a. blood stored in the bone marrow
   b. simple sugars through metabolism
   c. proteins within the muscles
   d. the movement of electrons between sodium and potassium

Objective 18

3. The _____ muscle adducts and flexes the leg.

   a. sartorius
   b. gluteus maximus
   c. gluteus medius
   d. gluteus minimus

Objective 18

4. The _____ muscle is the major muscle of the legs that inverts the ankle.

   a. extensor digitorum
   b. soleus
   c. peroneous
   d. tibialis

Objective 20

5. A hernia is _____.

   a. a tear in a tendon at the point of connection to the bone

   b. a general term for muscle pain

   c. a condition in which muscles are unable to process nutrients, resulting in cramps and eventually the death of the muscle tissue

   d. a protrusion of an abdominal organ, such as the small intestine, due to a weakness in the abdominal muscles

Objective 9

6. Moving a part so that its distal point travels in a circle is referred to as _____.

   a. *medial rotation*

   b. *lateral rotation*

   c. *inversion*

   d. *eversion*

Objective 20

7. _____ is an infection by an organism that releases a toxin that prevents muscle contraction.

   a. Contusion

   b. Botulism

   c. Salmonella

   d. Brucellosis

Objective 9

8. Bending a part at a joint is called _____.

   a. *elevation*

   b. *depression*

   c. *extension*

   d. *flexion*

Objective 9

9. A muscle that performs a movement toward a part or toward a midline is called _____.

   a. an *abductor*

   b. an *adductor*

   c. an *extensor*

   d. a *flexor*

Objective 17

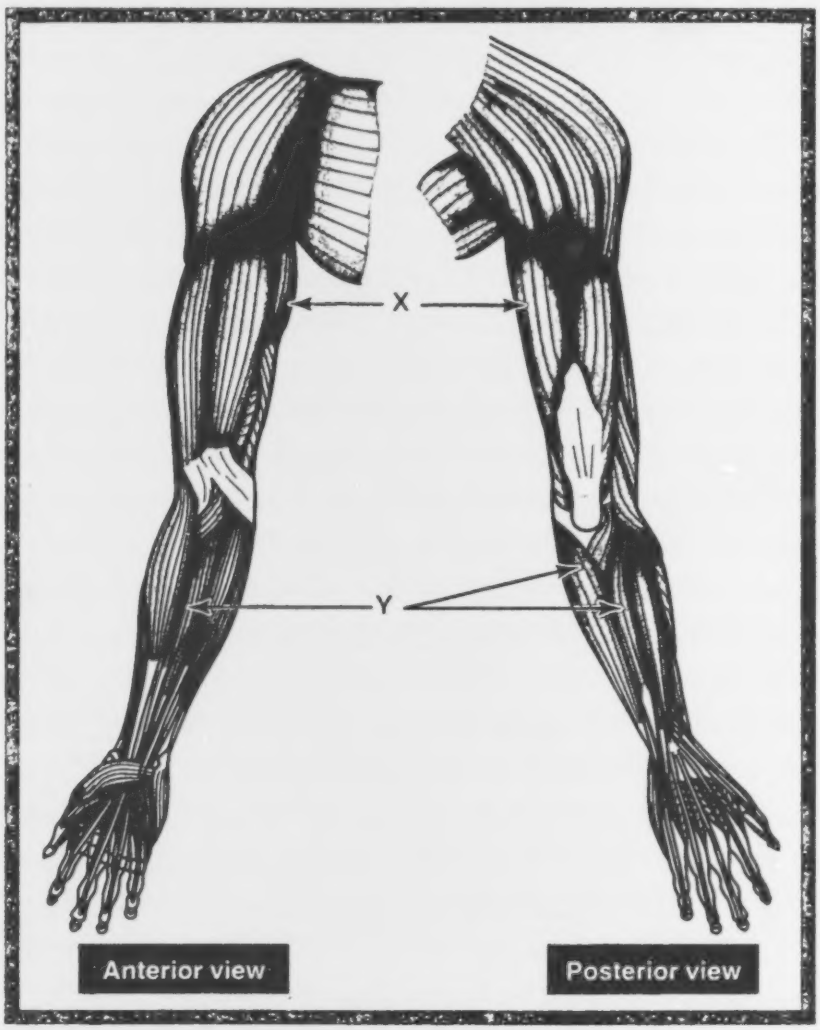
10. What muscle is indicated by the letter "X" in the illustration below?

    a. biceps brachii

    b. triceps brachii

    c. brachialis

    d. brachioradialis



Objective 17

11. What muscles are indicated by the letter "Y" in the illustration above?

    a. carpi muscles

    b. digitorum muscles

    c. tarsi muscles

    d. pollicis muscles

Objective 19

12. What muscle is indicated by the letter "X" in the illustration below?

    a. gastrocnemius

    b. hamstring

    c. adductor

    d. quadriceps femoris

Objective 19

13. What muscle is indicated by the letter "Y" in the illustration above?

    a. sartorius

    b. gluteus maximus

    c. gluteus medius

    d. gluteus minimus

Objective 13

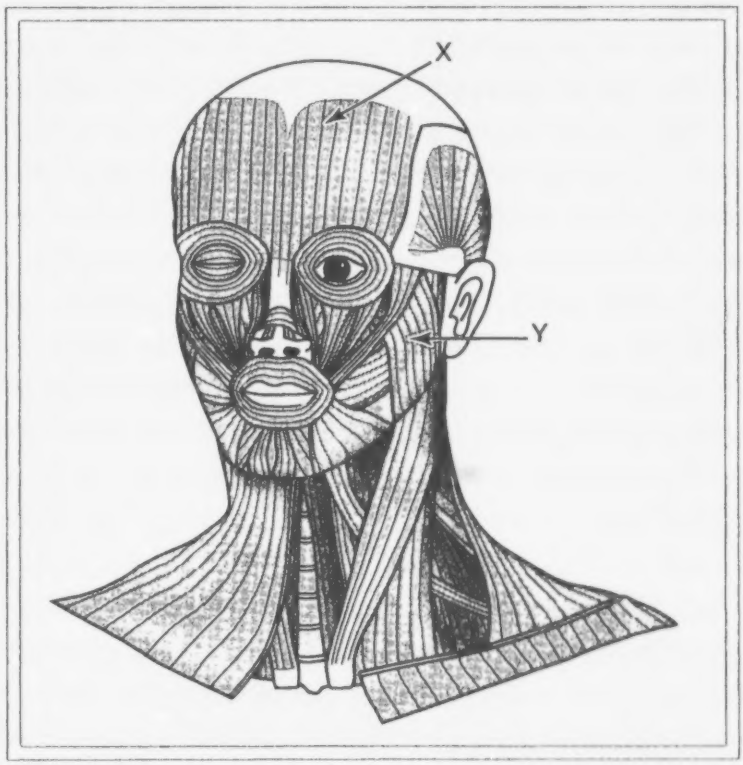
14. What muscle is indicated by the letter "X" in the illustration below?

    a. trapezius

    b. sternocleidomastoid

    c. platysma

    d. frontalis



Objective 13

15. What muscle is indicated by the letter "Y" in the illustration above?

    a. orbicularis oculi

    b. orbicularis oris

    c. buccinator

    d. masseter

Objective 20

16. Convulsions are _____.

    a. asynchronous contractions of individual tissue fibers within a muscle

    b. painful, involuntary twitches of a muscle

    c. abnormal, uncoordinated contractions of muscles

    d. an inflammation of muscle tissue

Objective 1

17. "All of the muscles of the body considered as an interrelated structural group" is the definition of _____.

    a. visceral muscle tissue
    b. the viscera
    c. skeletal muscle tissue
    d. the muscular system

Objective 18

18. Which muscle presses the thighs together?

    a. gastrocnemius
    b. hamstring
    c. adductor
    d. quadriceps femoris

Objective 14

19. The _____ is the major muscle of the torso that contracts and relaxes to cause inhalation and exhalation.

    a. latissimus dorsi
    b. diaphragm
    c. external oblique
    d. internal oblique

Objective 16

20. The _____ muscles are the major muscles of the arms that control thumb movements.

    a. carpi
    b. digitorum
    c. tarsi
    d. pollicis

Objective 14

21. The _____ is the major muscle of the torso that forms the floor of the pelvic cavity and supports the organs.

    a. transversus abdominis
    b. rectus abdominis
    c. levator ani
    d. internal oblique

Objective 15

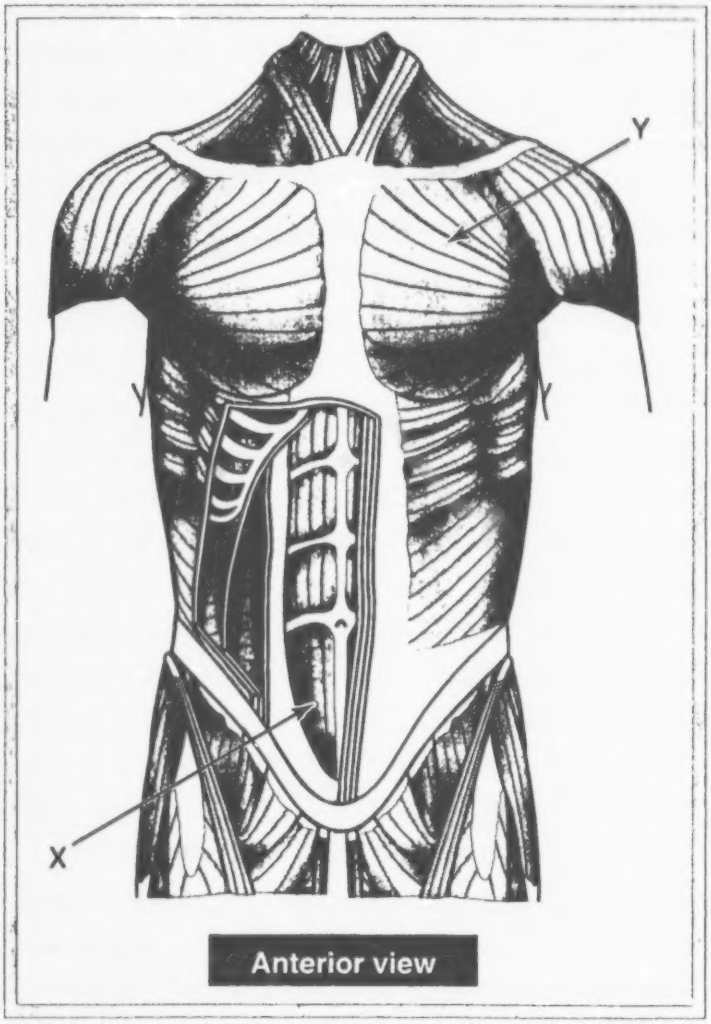
22. What muscle is indicated by the letter "X" in the illustration below?

a. transversus abdominis

b. rectus abdominis

c. levator ani

d. deep transverse perinei



Anterior view

Objective 15

23. What muscle is indicated by the letter "Y" in the illustration above?

a. deltoid

b. pectoralis major

c. serratus anterior

d. intercostals

Objective 20

24. The inability of the muscles to relax due to the presence of a toxin is called _____.

    a. *tetanus*
    b. *rigor*
    c. *tenosynovitis*
    d. *paralysis*

Objective 11

25. The primary function of the neck muscles is to _____.

    a. control talking, chewing, swallowing, facial expressions, and blinking
    b. move the head from side to side, from front to back, and in rotation
    c. allow the body to bend, turn, and stand erect
    d. assist in respiration and movements of the neck, arms, and trunk

Objective 20

26. _____ is a group of genetic diseases that lead to atrophy of the skeletal muscles.

    a. Muscular dystrophy
    b. Myasthenia gravis
    c. Fibromyositis
    d. Myalgia

Objective 10

27. Muscles that create a specific movement by flexing are called _____.

    a. *agonists*
    b. *antagonists*
    c. *synergists*
    d. *fixators*

Objective 7

28. The coordinated actions of a pair of muscles generally mean that one muscle contracts while the other _____.

    a. contracts more
    b. relaxes
    c. holds its position
    d. twists

Objective 9

29. The closing of a sphincter muscle is _____.

a. circumscription
b. circumvention
c. constriction
d. conscription

Objective 16

30. The _____ flexes the supinated forearm.

a. biceps brachii
b. brachialis
c. brachioradialis
d. all of the above

Objective 7

31. Muscles that move a body part usually lie _____ to the part that they move.

a. medial
b. lateral
c. distal
d. proximal

Objective 20

32. Tenosynovitis is an inflammation of _____.

a. muscle tissue
b. the tendon sheath
c. a tendon
d. ligaments

Objective 9

33. An example of a supinator performing supination is _____.

a. turning the palm upward
b. turning the palm downward
c. pointing the toes downward
d. none of the above

Objective 20

34. Localized internal bleeding within a muscle is referred to as a _____.

a. *convulsion*

b. *contusion*

c. *constriction*

d. *vascular breakdown*

Objective 11

35. The perineal muscles _____.

a. support the internal organs, assist in respiration, and assist in eliminating waste from the large intestine and bladder

b. assist in defecation and urination and form the floor of the pelvic cavity

c. form the perineal cavity

d. support the skin throughout the body

Objective 6

36. Skeletal muscles are enclosed in the _____.

a. myleum

b. aponeurosis

c. epimysium

d. periosteum

Objective 20

37. Muscle strain is _____.

a. a condition in which the muscle fibers have been overstretched or torn

b. muscle pain

c. a condition of weakness in a muscle due to lack of use

d. an asynchronous contraction of individual tissue fibers within a muscle

Objective 3

38. _____ muscle tissue is involuntary, is partially striated, is found only in the heart, and contracts moderately fast in response to stimulation to nerve impulses.

a. Skeletal

b. Smooth

c. Visceral

d. Cardiac

Objective 15

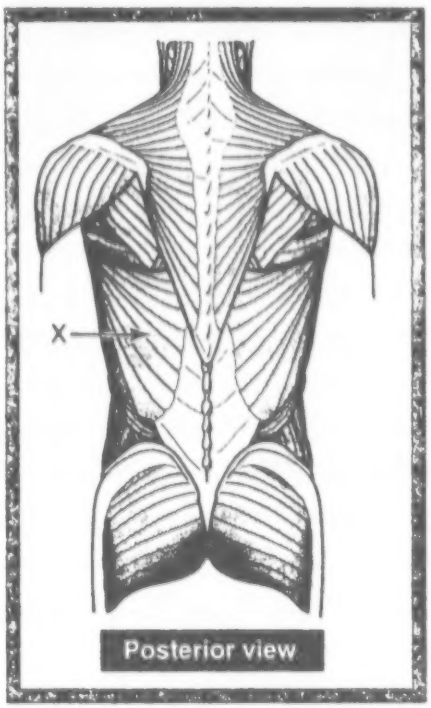
39. What muscle is indicated by the letter "X" in the illustration below?

a. latissimus dorsi

b. diaphragm

c. external oblique

d. internal oblique



Objective 7

40. Muscles contract in response to _____.

a. increased heat

b. chemical stimulus

c. electrical impulses

d. proton flow

Objective 2

41. Which of the following is NOT a major function of the muscular system?

a. assists in body movements and in maintaining posture and balance

b. assists in the movement of materials internal to the body

c. produces blood and hormones

d. helps to protect the internal organs

Objective 8

42. The ability of a muscle to respond to stimuli is called _____.

a. *irritability*

b. *elasticity*

c. *conductivity*

d. *extensibility*

Objective 6

43. Skeletal muscles are firmly attached to the structures on which they pull during _____.

a. contraction

b. extension

c. contusion

d. conduction

Objective 7

44. Locomotion of the body is caused by muscles pulling on _____.

a. bones

b. each other

c. nerves

d. all of the above

Objective 8

45. The slight tension that is present in muscles even when they are at rest so that they can respond more easily and quickly when needed is called _____.

a. *contractility*

b. *durability*

c. *flexion*

d. *tone*

Objective 14

46. Which of the following muscles is primarily responsible for flexing the upper arm, adducting the upper arm anteriorly, and drawing the arm across the chest?

a. deltoid

b. pectoralis major

c. serratus anterior

d. intercostals

Objective 19

47. What muscle is indicated by the letter "X" in the illustration below?

a. extensor digitorum

b. soleus

c. sartorius

d. tibialis anterior

Objective 20

48. Myalgia is _____.

a. localized internal bleeding within a muscle

b. an inflammation of muscle tissue

c. muscle pain

d. a group of genetic diseases that lead to atrophy of the skeletal muscles

Objective 6

49. Skeletal muscles may be attached directly to the periosteum of a bone or may be attached by _____.

    a. ligaments

    b. tendons or aponeuroses

    c. bone spurs

    d. bone processes

Objective 5

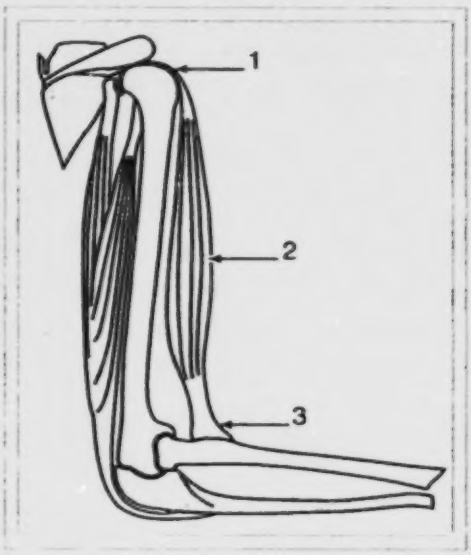
50. In the illustration below, what is the correct association between major structures of skeletal muscles and the numbers in the illustration?

    a. (1) origin, (2) body, (3) insertion

    b. (1) body, (2) insertion, (3) origin

    c. (1) insertion, (2) origin, (3) body

    d. (1) insertion, (2) body, (3) origin



Objective 12

51. The _____ is the major muscle of the neck, head, and face that moves the shoulders by raising, assists in moving the head to one side or the other, hyperextends the head when the occiput acts as insertion, and helps hold the head erect.

    a. masseter

    b. trapezius

    c. sternocleidomastoid

    d. platysma

Objective 4

52. The end of a skeletal-muscle attachment that is attached to the more-movable bone is the _____.

    a. origin

    b. body

    c. insertion

    d. voluntary tissue

Objective 3

53. Which of the following is NOT a characteristic of skeletal muscle tissue?

    a. is voluntary

    b. is striated, consisting of long, slender, striped cells

    c. is attached to the skeleton and moves the skeleton's moving parts, acting in opposing groups with some muscles relaxing and some contracting

    d. contracts slowly in response to stimulation of nerve impulses

Objective 12

54. The _____ is the major muscle of the neck, head, and face that wrinkles the forehead horizontally.

    a. temporalis

    b. frontalis

    c. orbicularis oculi

    d. orbicularis oris

Objective 20

55. A condition of weakness in a muscle due to lack of use is called _____.

    a. *atrophy*

    b. *distrophy*

    c. *dysfunctional myalgia*

    d. *tetanus*

Answers to Module Review

1. c
2. b
3. a
4. b
5. d
6. b
7. b
8. d
9. b
10. b
11. a
12. a
13. b
14. d
15. d
16. c
17. d
18. c
19. b
20. d
21. c
22. b
23. b
24. a
25. b
26. a
27. a
28. b
29. c
30. a
31. d
32. b
33. a
34. b
35. b
36. c
37. a
38. d
39. a
40. c
41. c
42. a
43. a
44. a
45. d
46. b
47. a
48. c
49. b
50. a
51. b
52. c
53. d
54. b
55. a

MODULE SET II:
Major Body Systems

Module 4: Nervous System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Nervous System	9
2—Major Subsystems of the Nervous System	11
3—Major Subsystems of the Peripheral Nervous System	13
4—Major Structures of a Neuron	15
5—Major Structures of a Nerve Fiber	17
6—Types of Neurons	19
7—Transmission of Nerve Impulses	21
8—Major Structures of a Reflex Arc	23
9—Stages in the Regeneration of a Peripheral Nerve	25
10—Cross-Section of the Spinal Cord	27
11—Primary Divisions of the Brain	29
12—Major Structures of the Forebrain and Hindbrain	31
13—The Visible Lobes and Fissures of the Cerebrum	33
14—The Functional Areas of the Brain	35
15—The Ventricles of the Brain and the Horns of the Lateral Ventricles	37
16—The Cranial Nerves of the Peripheral Nervous System	39
17—The Plexuses of the Spinal Cord	41
Written Test	43
Answers to Written Test	63
Answers to Assignment Sheet	71
Crossword Puzzles	
1—Terms from Objectives 1 Through 4	73
2—Terms from Objectives 5 Through 10	75
3—Terms from Objectives 11 Through 19	77
4—Terms from Objectives 20 Through 26	79
5—Terms from Objectives 28 Through 30	81
6—Terms from Objectives 33 Through 35	83
7—Terms from Objectives 36 Through 39	85
8—Terms from Objective 40	87
9—Terms from Objective 40 (cont.)	89
Answers to Crossword Puzzles	91
Module Review	95
Answers to Module Review	121

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** The nervous system is typically one of the more-difficult anatomical systems for students to grasp during their studies. This is partially because the products of the nervous system are virtually invisible. Further, the concepts of central, peripheral, autonomic, sympathetic, and parasympathetic nervous systems confuse students. Therefore, it is especially critical to assist the students in visualizing the nervous system and understanding its functioning.

- Introduce the module by demonstrating reflex taps. Explain what is happening and allow students to experience both giving and receiving reflex taps. Relate the reflex response to the functions of the nervous system. Demonstrate other reflexes that illustrate the functions of the nervous system. For example, demonstrate pupil dilation and constriction when exposed to light. Discuss autonomic and conscious control of body functions. Have the students explain whether they think that breathing is autonomic or consciously controlled.
- Use crossword puzzles 1 through 9 to help reinforce the terms in the associated objectives.
- For Objective 3 through Objective 5, which describe the major subsystems of the nervous system, use Figure 2 and Figure 3 in the student edition to illustrate the descriptions. Then, provide a model or actual vertebral column to illustrate how the PNS branches out from the CNS.

  Also discuss the role of the autonomic nervous system. Recall your earlier discussion about whether breathing is autonomous. Provide the students with information about biofeedback and the apparent involvement of the conscious mind to influence body functions such as blood pressure, heart rate, etc. Emphasize to students that the ANS is not a physically separate system. Discuss the sympathetic and parasympathetic nervous systems. Discuss fight or flight reaction.
- Objective 6 through Objective 14 discuss nerve tissue, define the basic types of nerve tissue, discuss the major structures of a neuron, define the term *nerve fiber* and the major structures of a nerve fiber, describe types of neurons, and describe the transmission of nerve impulses. Relate the parts of a neuron to what students already know about the parts and structure of cells. Point out how the structure of the neuron supports its specialized functioning. Use this discussion to lead into the objective about the functions of the neuron. Relate the functioning of the neuron to an electrical circuit with a battery, pointing out how energy is stored and transmitted. Continue this discussion to cover the types of neurons and their functions in the overall process.

  Ask the students to explain how a motor activity such as playing a piano or using a computer keyboard can become easier with practice. Lead the discussion to an explanation of synapses and the transmission of nerve signals.

- Objective 15 and Objective 16 describe and illustrate a reflex arc. Explain why reflex arcs offer an advantage and how this pathway differs from normal nerve circuits.
- Objective 17 describes the stages in the regeneration of a peripheral nerve. Use the illustration with the objective in the student edition to help students understand this process.
- Objective 18 states the functions of the types of neuroglia. Have students review the definitions in Objective 7 before you begin discussing Objective 18. Stress the role neuroglia play when there is injury or infection in the nervous system as you discuss microglia, astrocytes, and ependyma, and stress the role neuroglia play in supporting neurons as you discuss oligodendrocytes.
- Objective 19 through Objective 39 discuss the major structures of the spinal canal, the components of cerebrospinal fluid, the meninges, the primary structures of the brain, the cranial nerves, the plexuses of the spinal cord, and the nerves that arise from each plexus. Use the following strategies for these objectives.
  - — Exhibit a sample of spinal fluid and discuss its components.
  - — Using the transparencies or other illustrations, discuss the layers of the meninges. Point out the term *arachnoid* and relate it to spiders to help students remember how the layers are named.
  - — Using illustrations, models, and MRI imaging, discuss the parts and structure of the brain. Discuss the functions of those parts. Continue the discussion to relate the parts of the brain to functional areas. Point out the fissures and explain their relationships to the parts of the brain. Do the same with the ventricles.
  - — Use an illustration to show the names and numbers of the cranial nerves. Discuss their functions. Point out to the students that many of the names are directly related to the function, such as *optical* and *sight*.
  - — Use illustrations and models to discuss the spinal nerves and the plexuses.
- To supplement Objective 40, which defines the common disorders and abnormalities of the nervous system, visit an imaging center to witness CT and MRI scanning. Invite a neurosurgeon to talk to the class about disorders of the nervous system and appropriate treatments. Provide examples of electroencephalograms of various disorders. Discuss CVAs.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.

- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites provide information specifically about the nervous system, though pages within the web site may provide information about other systems. If more general information about anatomy and physiology is desired, refer to the supplemental resources in Module Set I.

- http://www.maui.net/~jms/brainuse.html

  This site deals primarily with the brain and offers many useful graphics.

- http://www.cid.ch/DAVID/Mainmenu.html

  This is a rich gallery of CAT scans that can be explored through links to various sections of the body.

- http://www9.biostr.washington.edu/da.html

  This site provides images and information in four areas: the brain, neuroanatomy, thoracic viscera, and the knee.

- http://www.a-better-way.com/systems/

  This site provides text on systems and disorders with reinforcement quizzes. A word of caution is required because the site does emphasize alternative treatments such as nutrition.

- http://www.vh.org/Providers/Textbooks/BrainAnatomy/BrainAnatomy.html

  This site includes photos of dissections of nervous systems with labeled drawings.

- http://www.med.harvard.edu/AANLIB/home.html

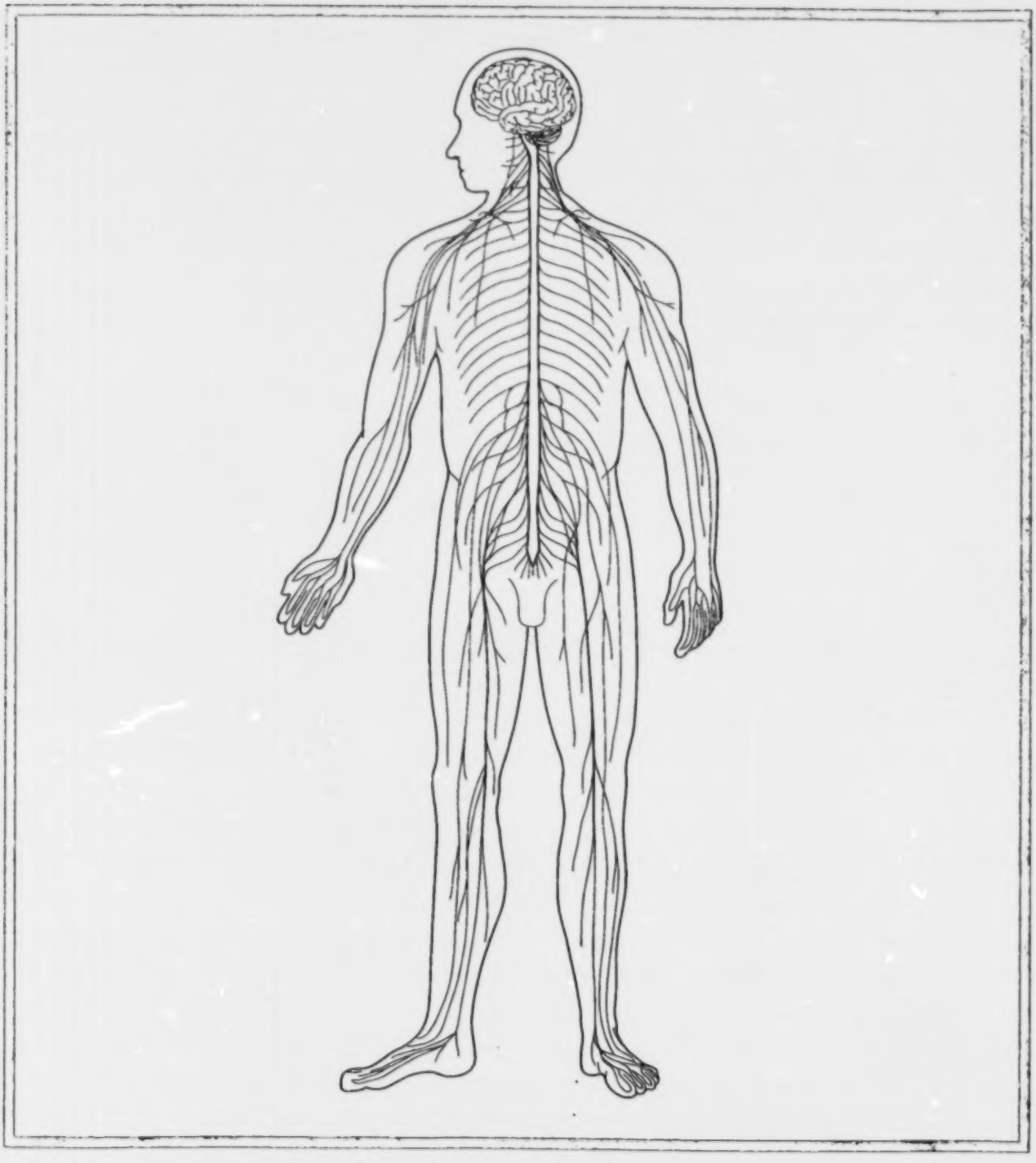
  Detailed information on the brain and nervous-system abnormalities with imaging are a major part of this site.

- http://laxmi.nuc.ucla.edu:8888/Teachers/pphelps/Published_Trays/NS_X_Sectioned_Imgs_PS97/lab8.html

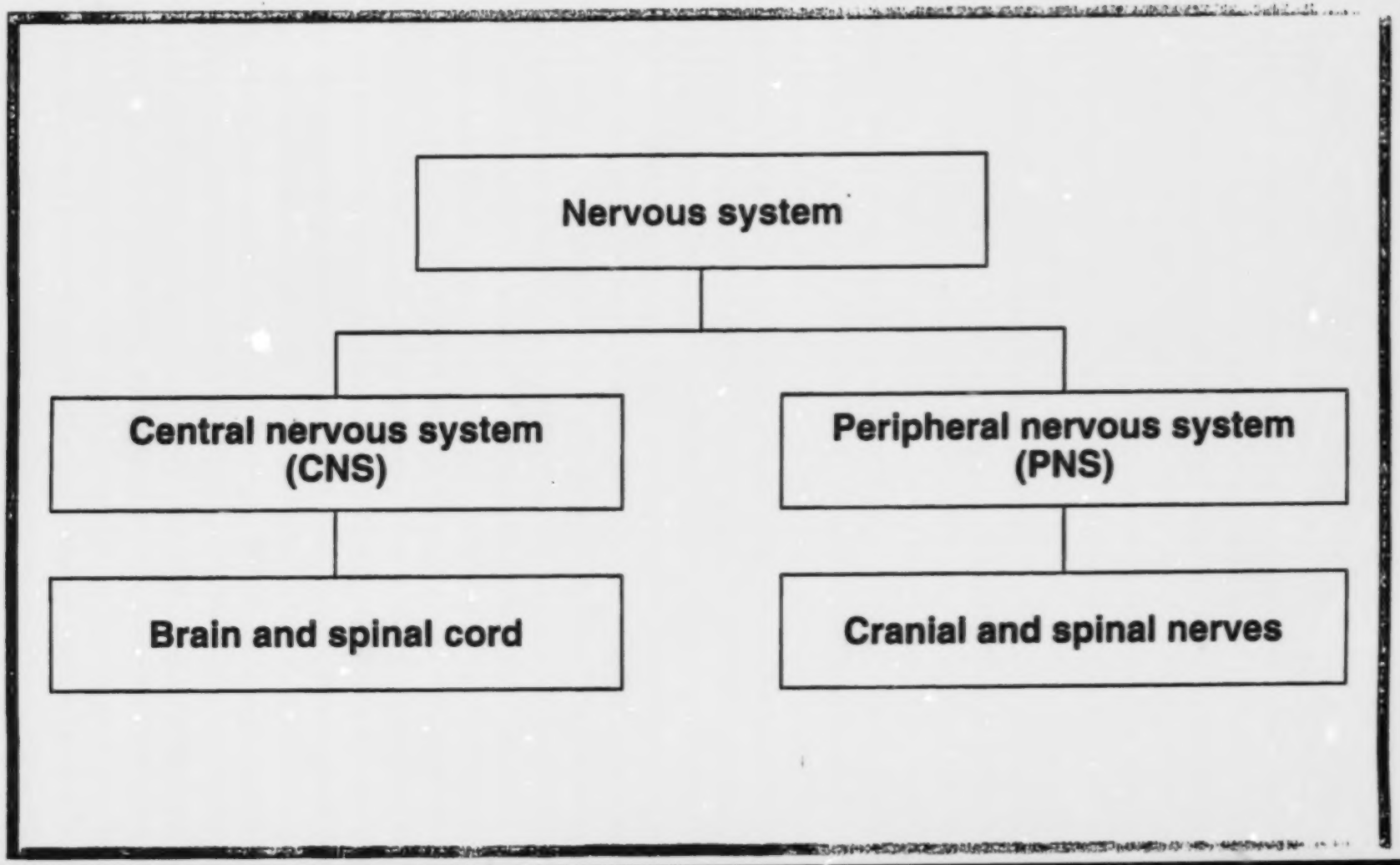
  Provides photos of nervous-system components with labeled/unlabeled views. This site illustrates many nerves not included in the module in the student edition.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

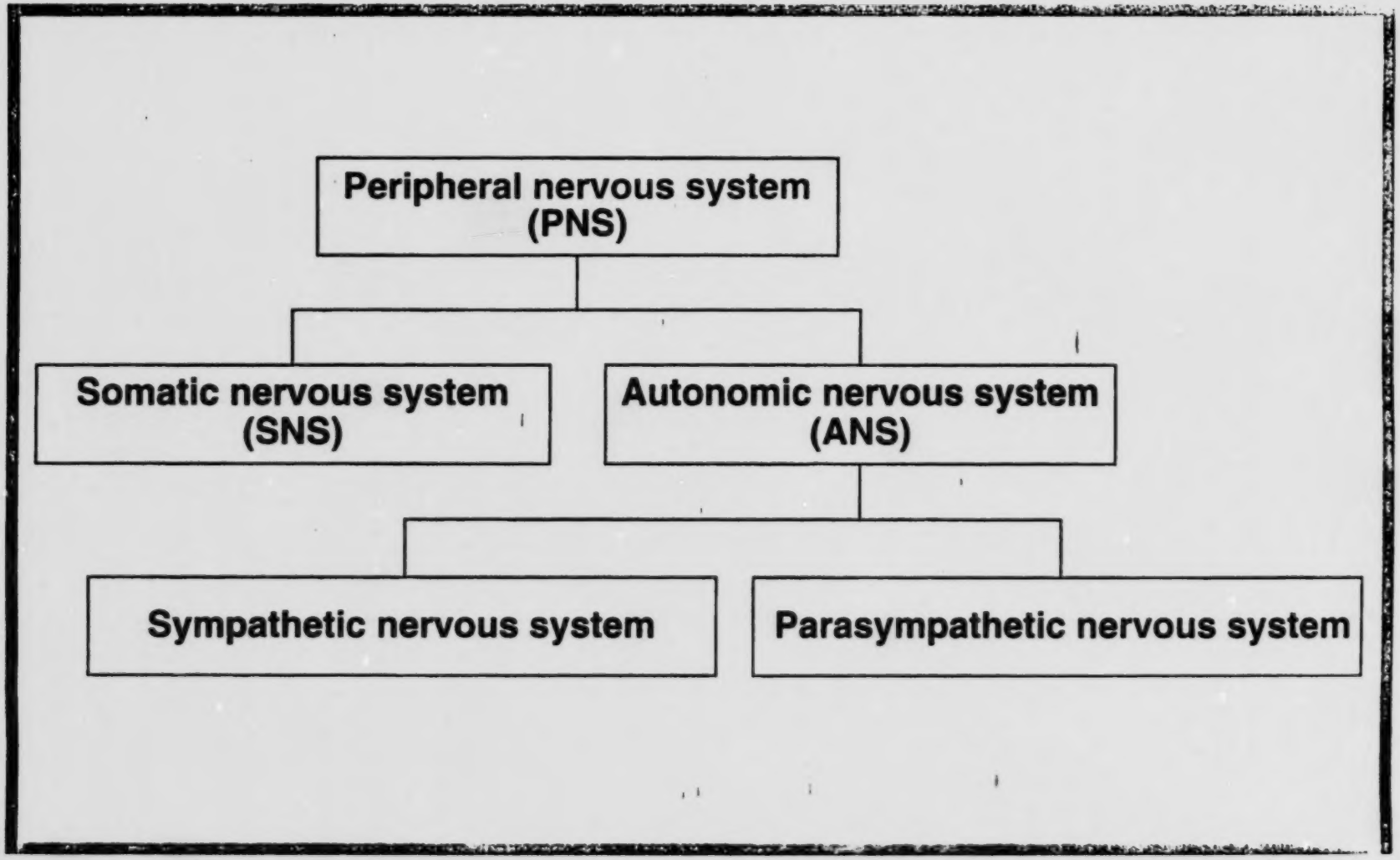
Nervous System



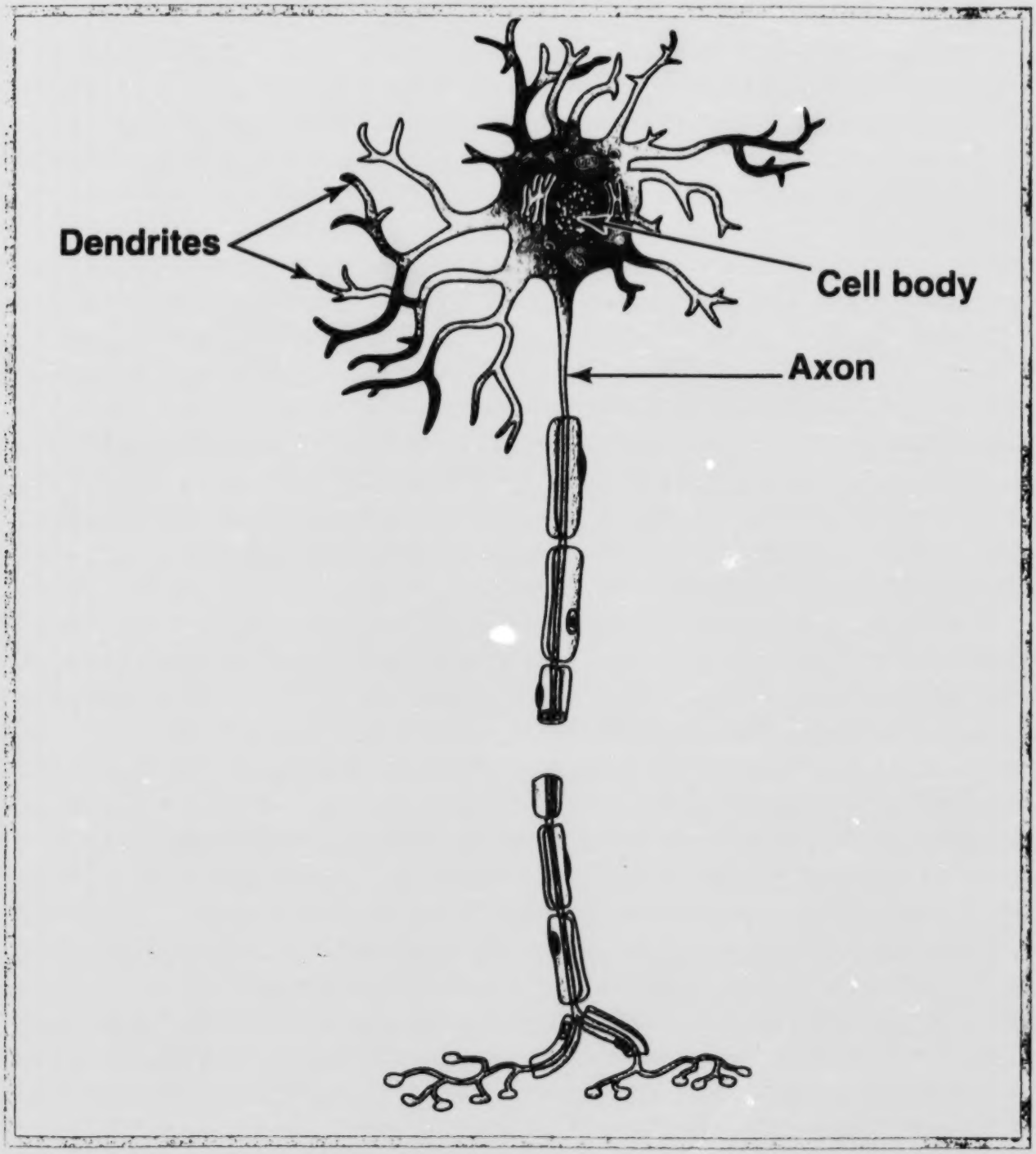
Major Subsystems of the Nervous System



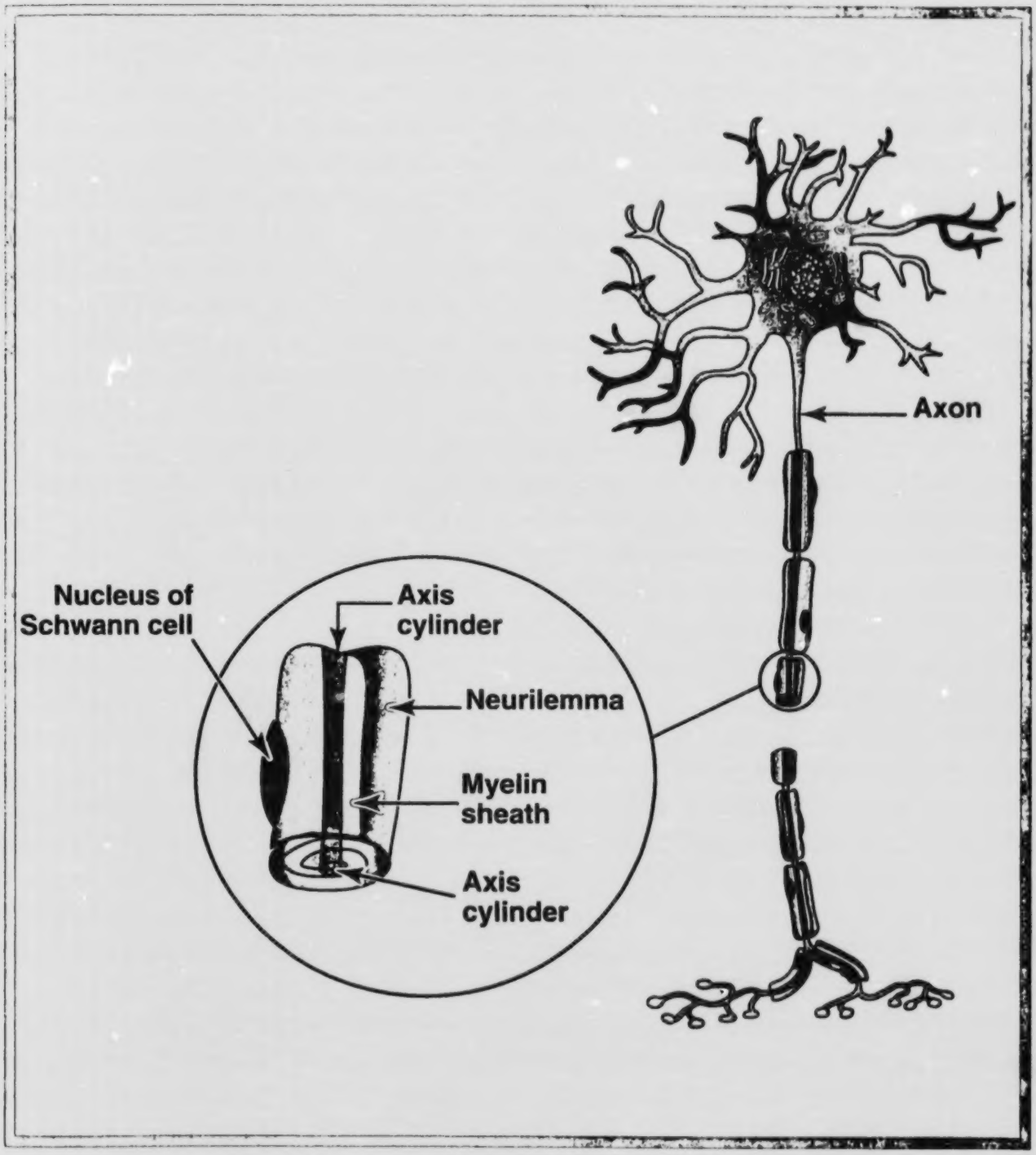
Major Subsystems of the Peripheral Nervous System



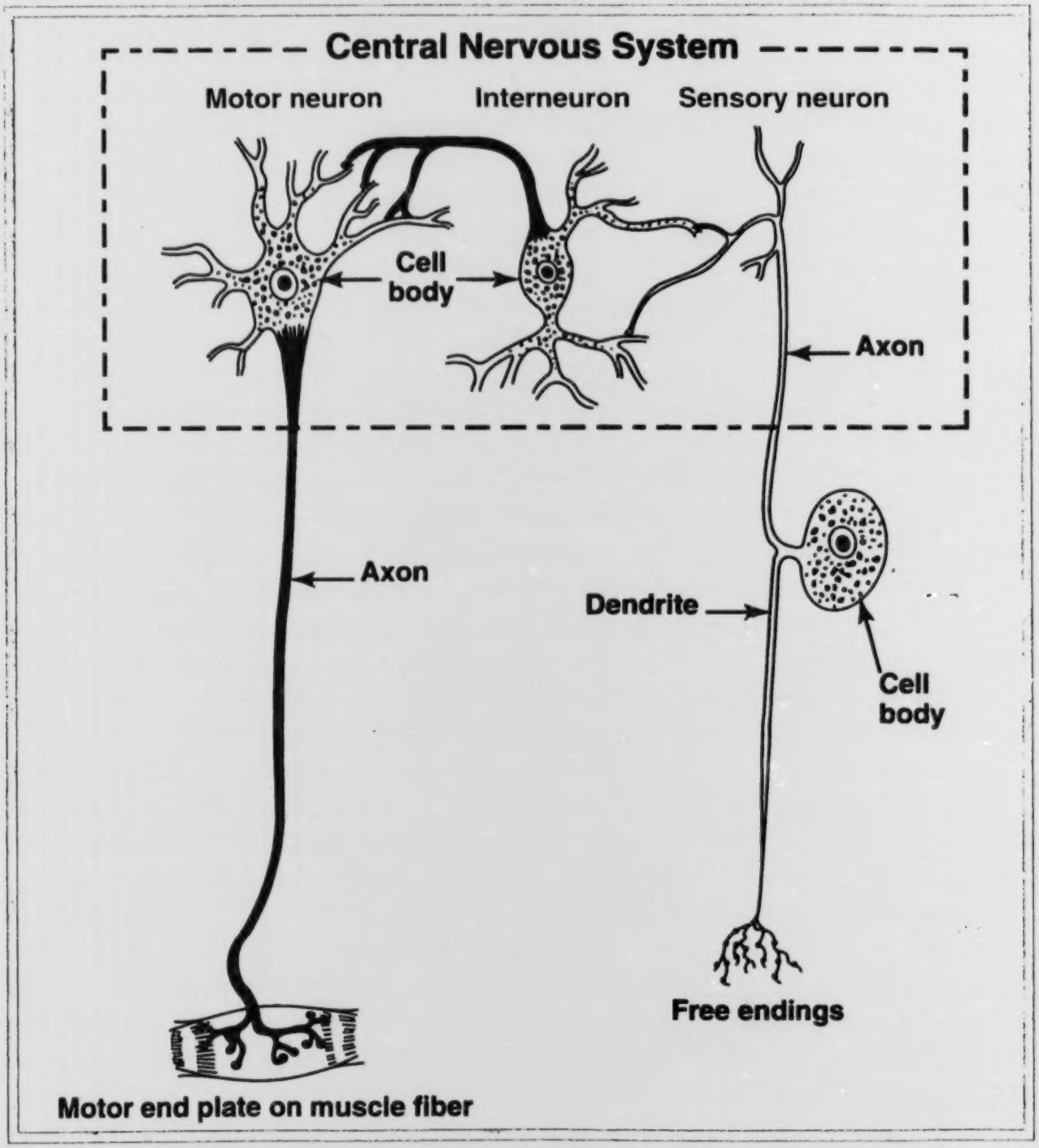
Major Structures of a Neuron



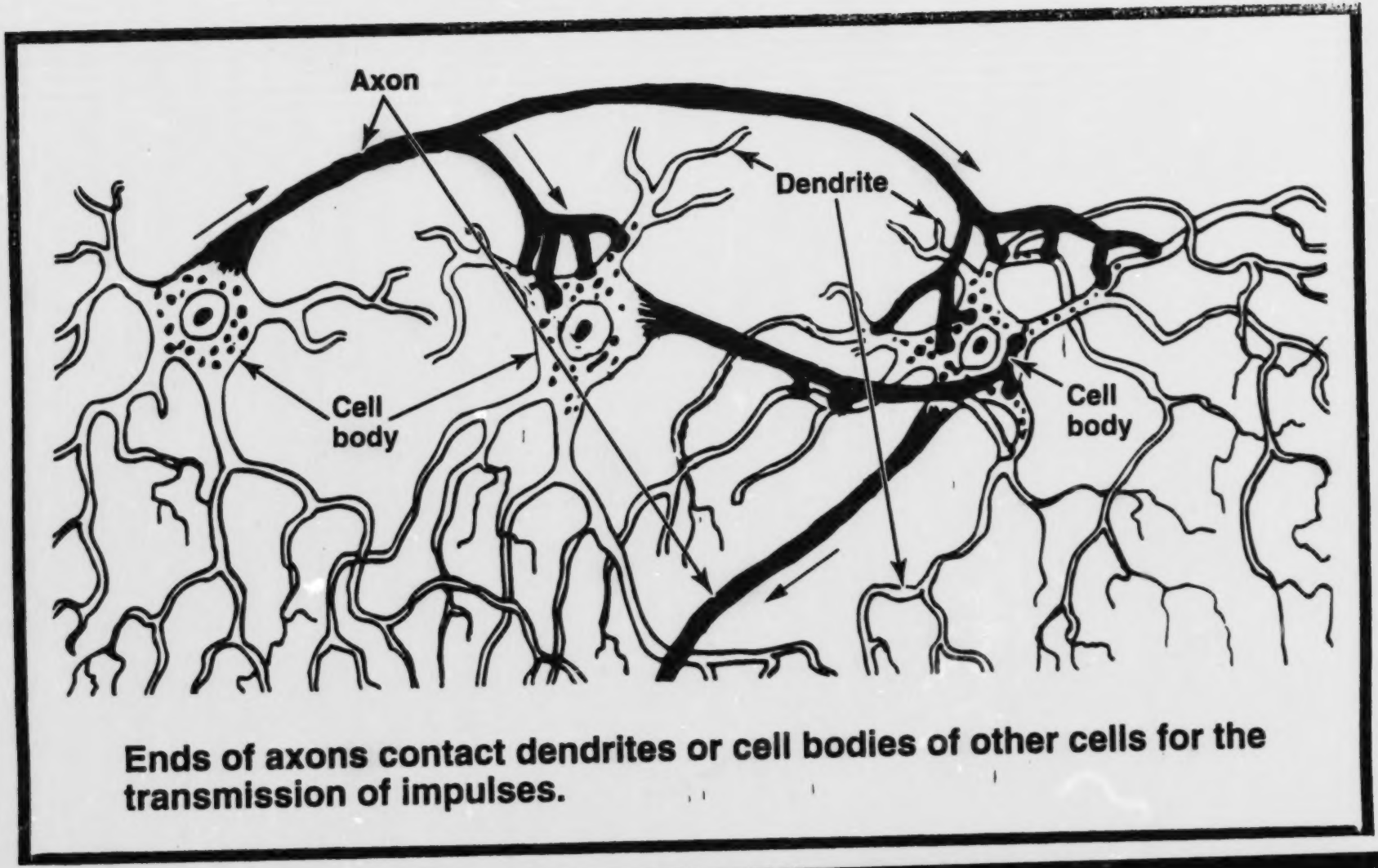
Major Structures of a Nerve Fiber



Types of Neurons

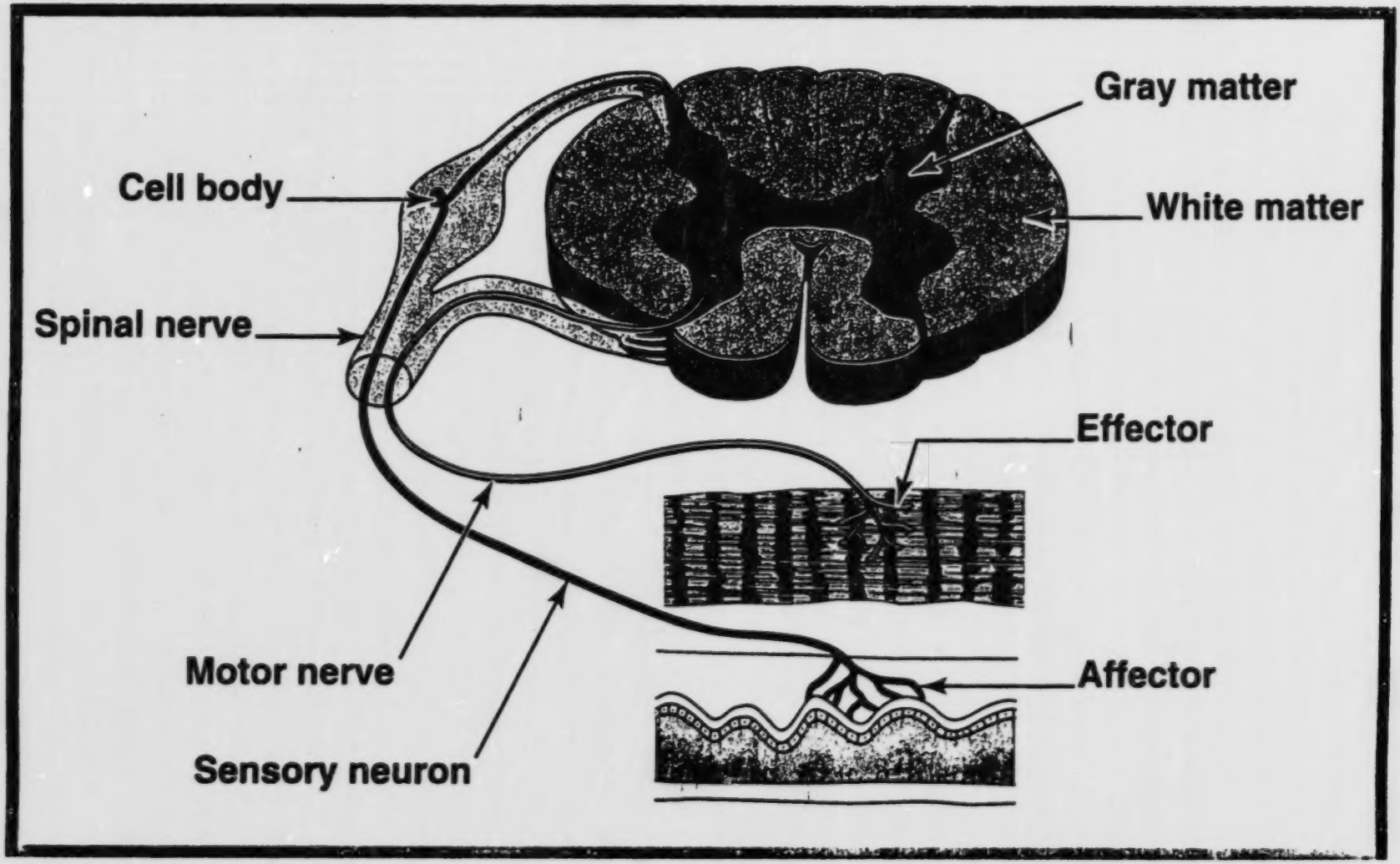


Transmission of Nerve Impulses

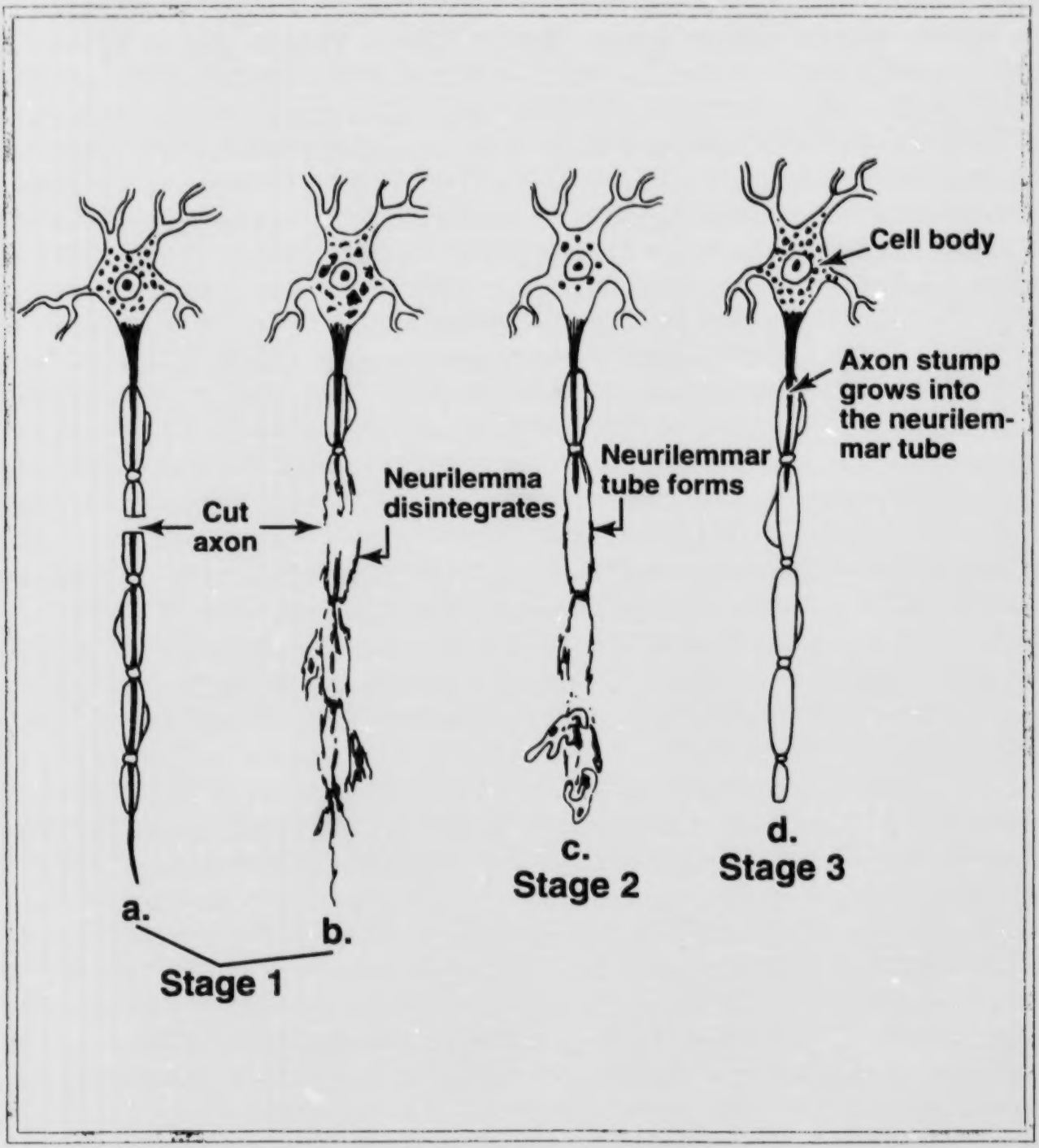


Ends of axons contact dendrites or cell bodies of other cells for the transmission of impulses.

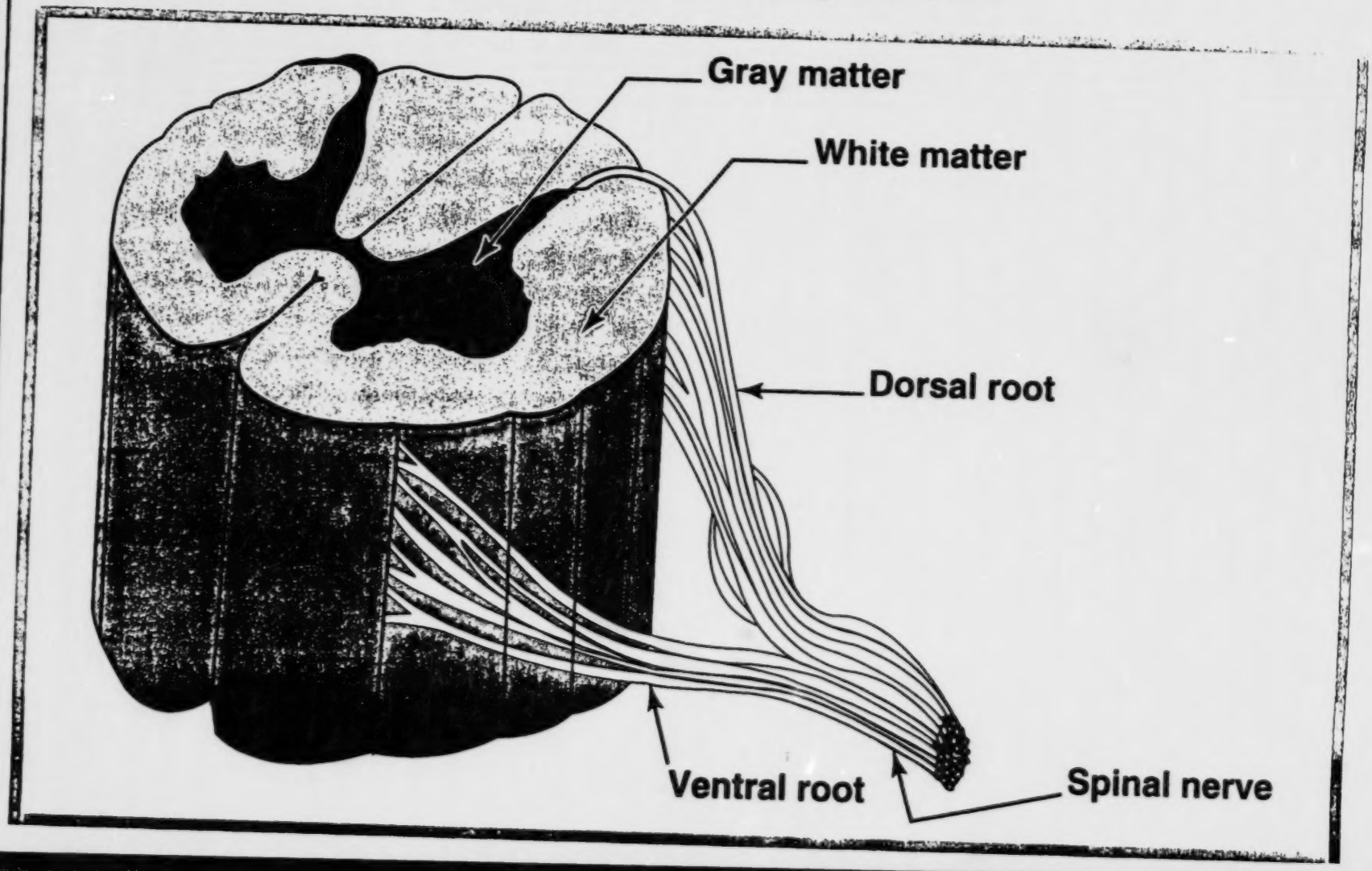
Major Structures of a Reflex Arc



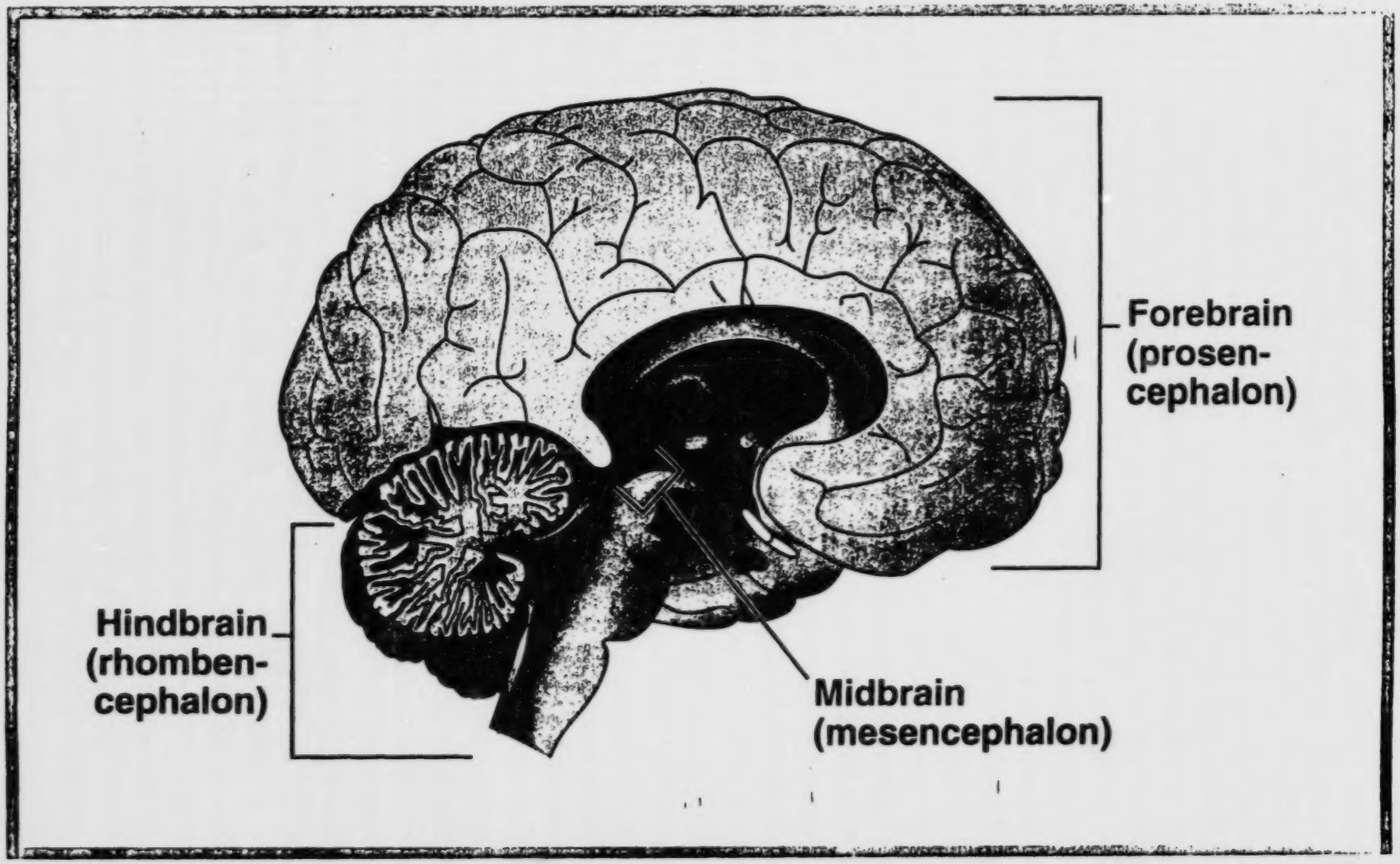
Stages in the Regeneration of a Peripheral Nerve



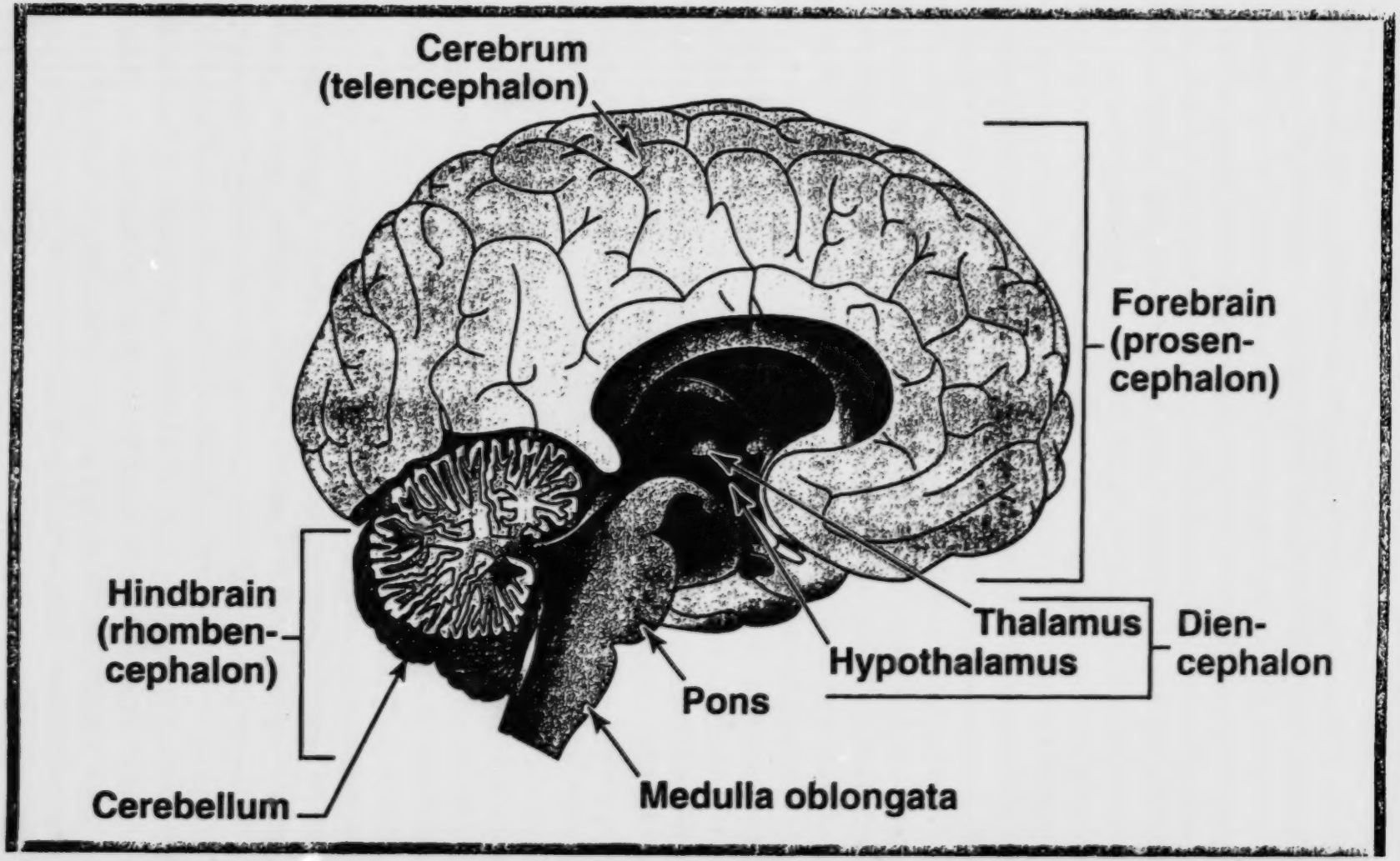
Cross-Section of the Spinal Cord



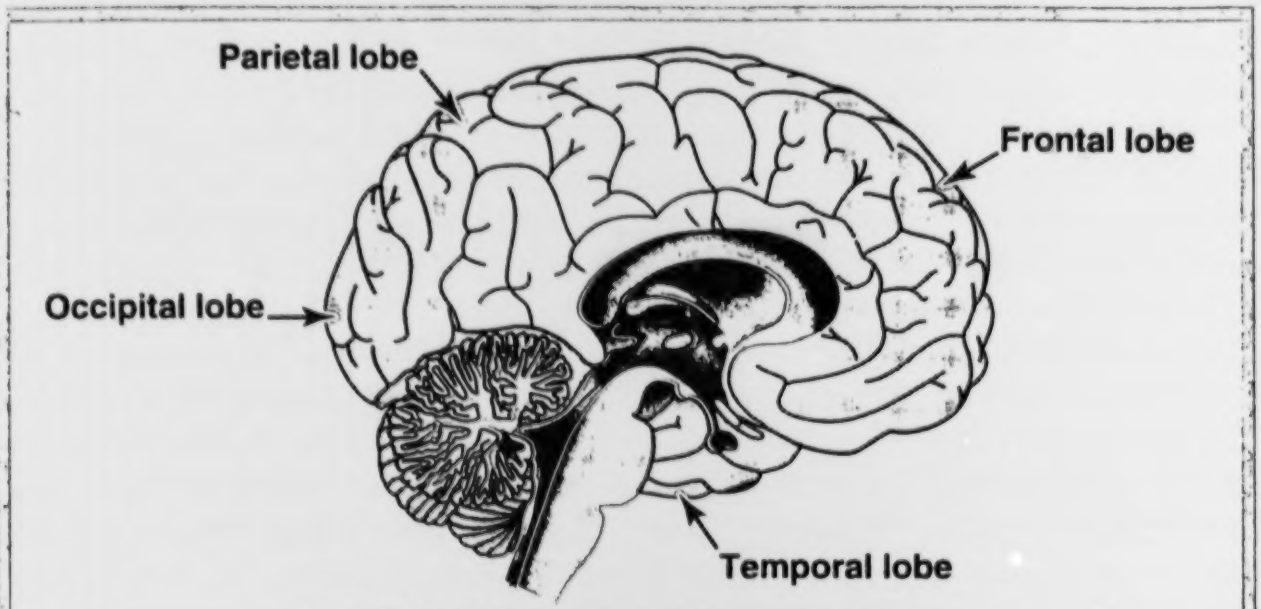
Primary Divisions of the Brain



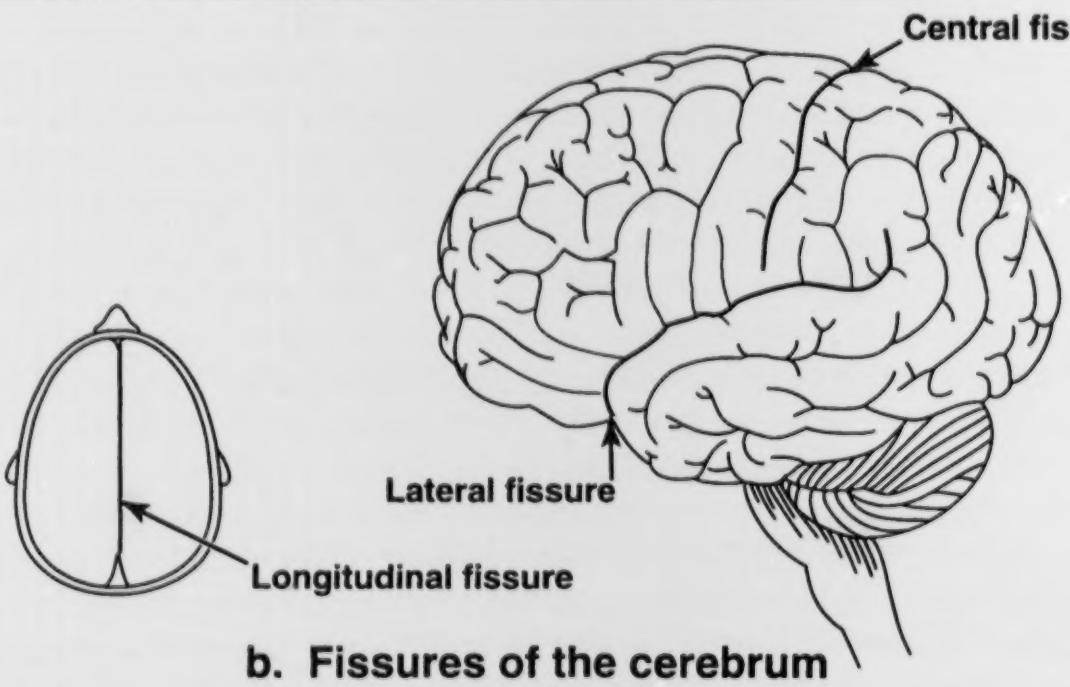
Major Structures of the Forebrain and Hindbrain



The Visible Lobes and Fissures of the Cerebrum

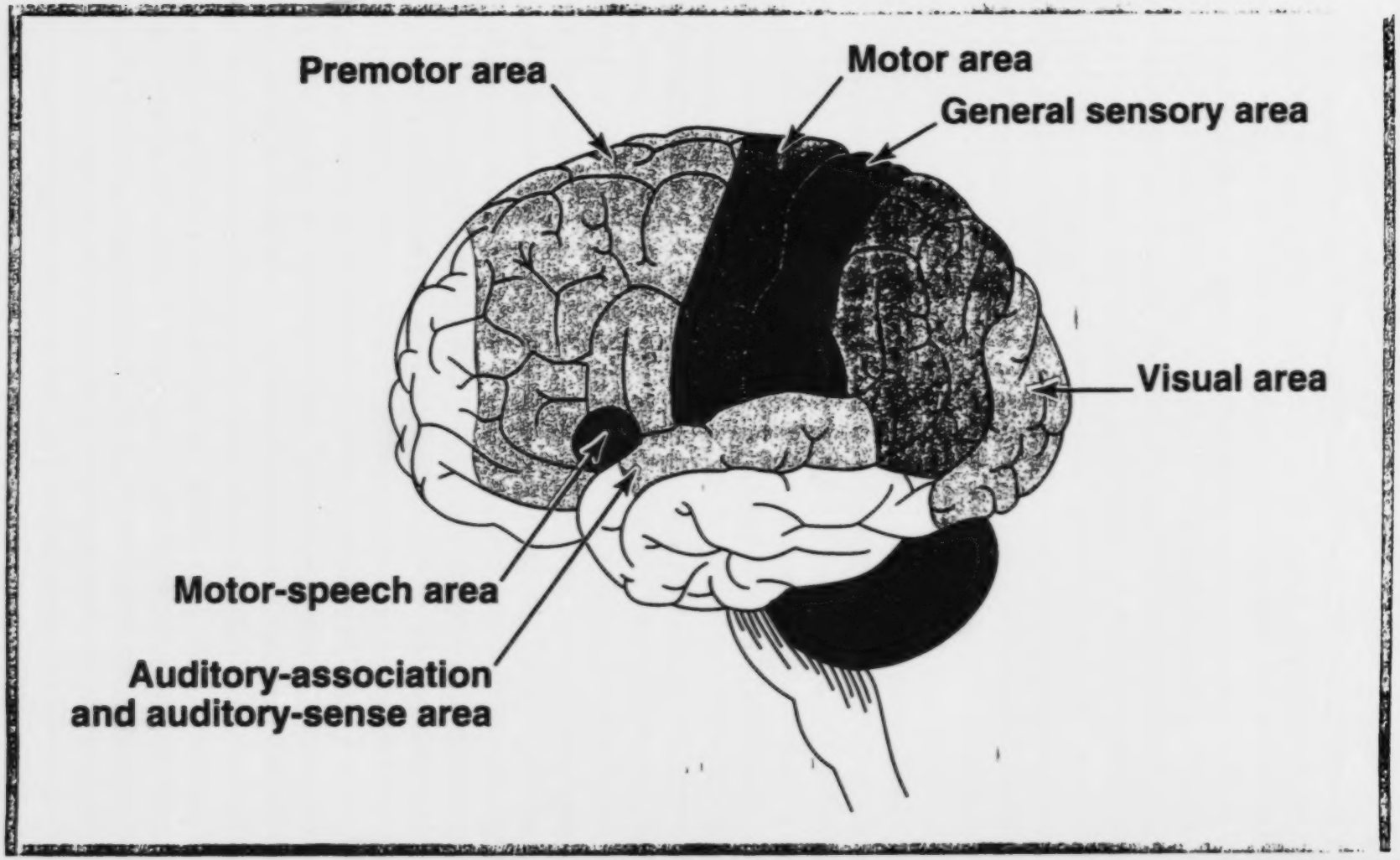


a. Visible lobes of the cerebrum

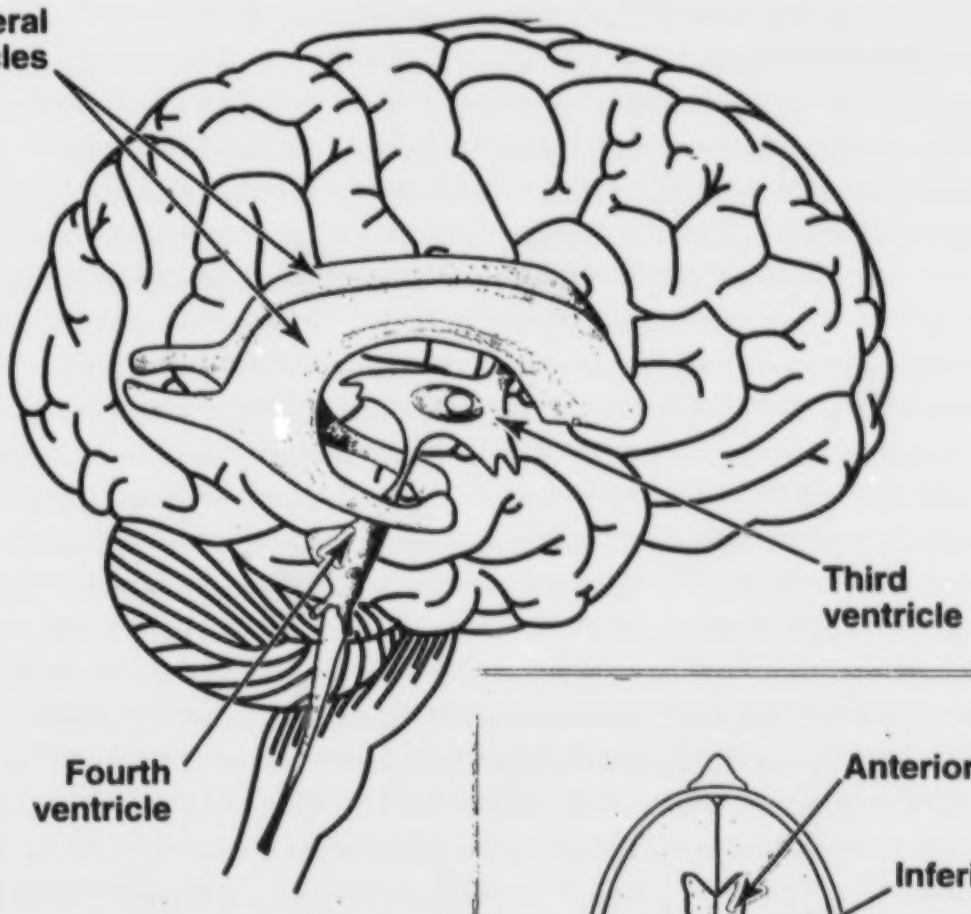


b. Fissures of the cerebrum

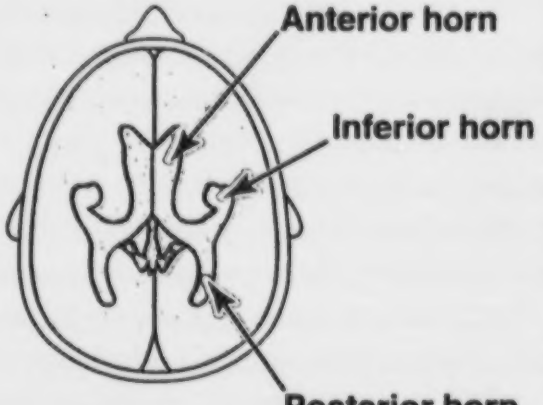
The Functional Areas of the Brain



The Ventricles of the Brain and the Horns of the Lateral Ventricles

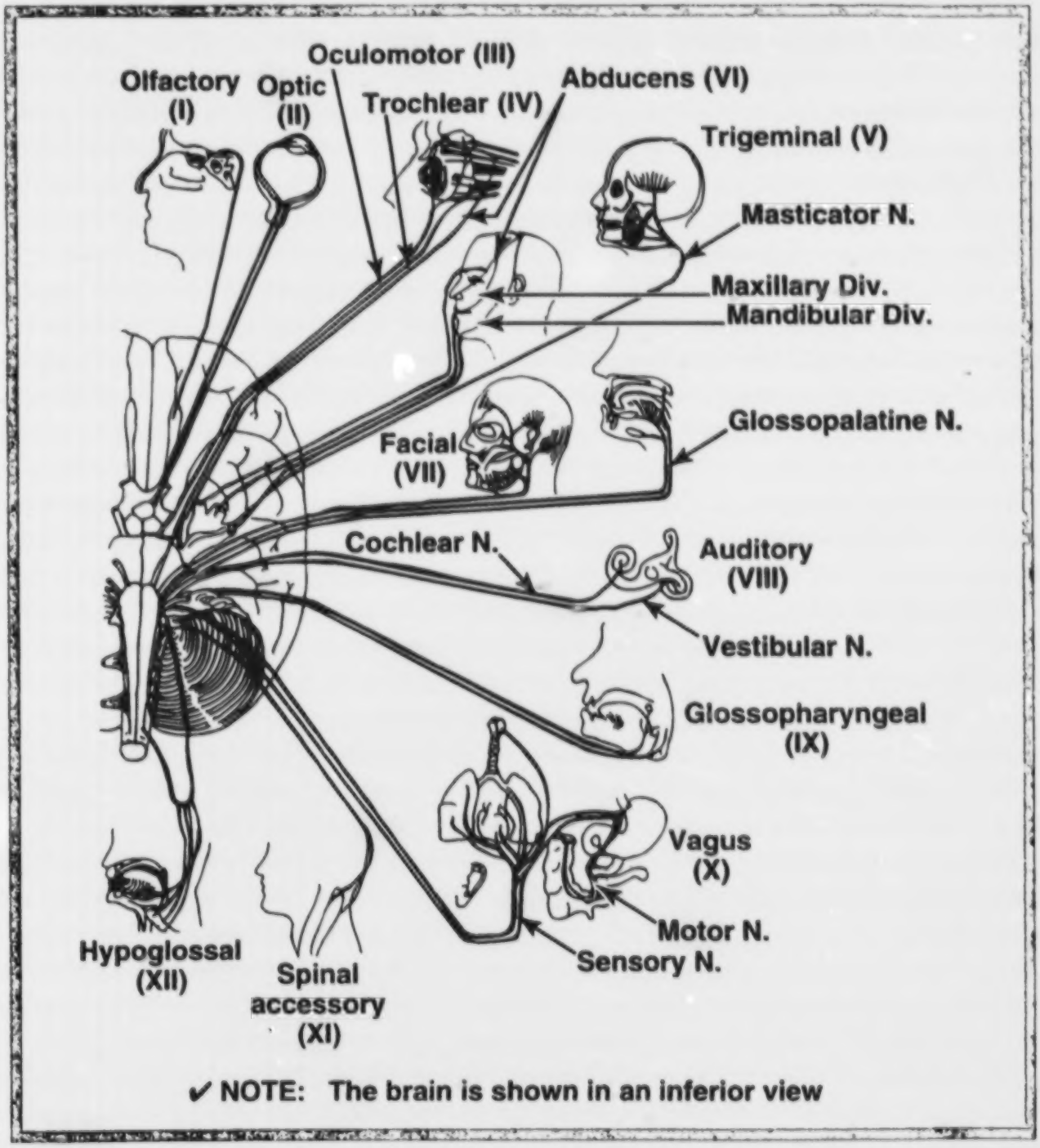


Ventricles of the brain



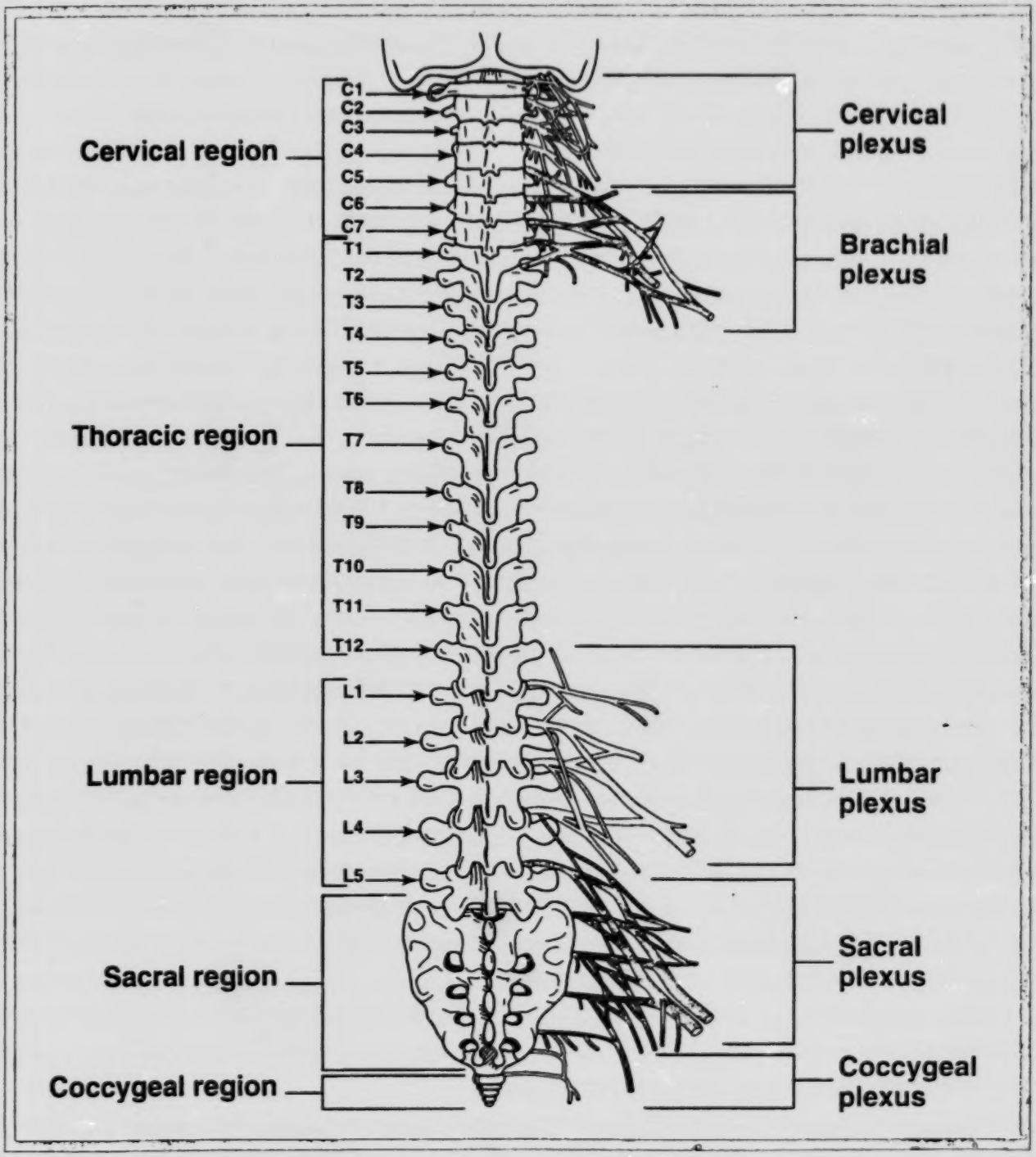
Horns of the lateral ventricles

The Cranial Nerves of the Peripheral Nervous System



✔ NOTE: The brain is shown in an inferior view

The Plexuses of the Spinal Cord



Written Test

Name _____

Date _____ Score _____

OBJECTIVE 1 Define the term *nervous system*. Write your answer on the blank lines provided beside the term below.

Nervous system _____

_____

OBJECTIVE 2 State the functions of the nervous system. Write your answers on the blank lines provided below.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

OBJECTIVE 3 Describe the major subsystems of the nervous system. Write your answers on the blank lines provided beside each of the terms below.

a. Central nervous system (CNS) _____

_____

_____

_____

b. Peripheral nervous system (PNS) _____

_____

_____

_____

Objective 4 Describe the major subsystems of the peripheral nervous system (PNS). Write your answers on the blank lines provided beside each of the terms below.

a. Somatic nervous system (SNS) _____

_____

_____

b. Autonomic nervous system (ANS) _____

_____

_____

Objective 5 Describe the major subsystems of the autonomic nervous system (ANS). Write your answers on the blank lines provided beside each of the terms below.

a. Sympathetic nervous system _____

_____

b. Parasympathetic nervous system _____

_____

Objective 6 Define the term *nerve tissue*. Write your answer on the blank lines provided beside the term below.

Nerve tissue _____

_____

Objective 7 Define the basic types of nerve tissue. Write your answers on the blank lines provided beside each of the terms below.

a. Neurons _____

_____

b. Neuroglia _____

_____

Objective 8 State the functions of the major structures of a neuron. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Cell body _____

_____

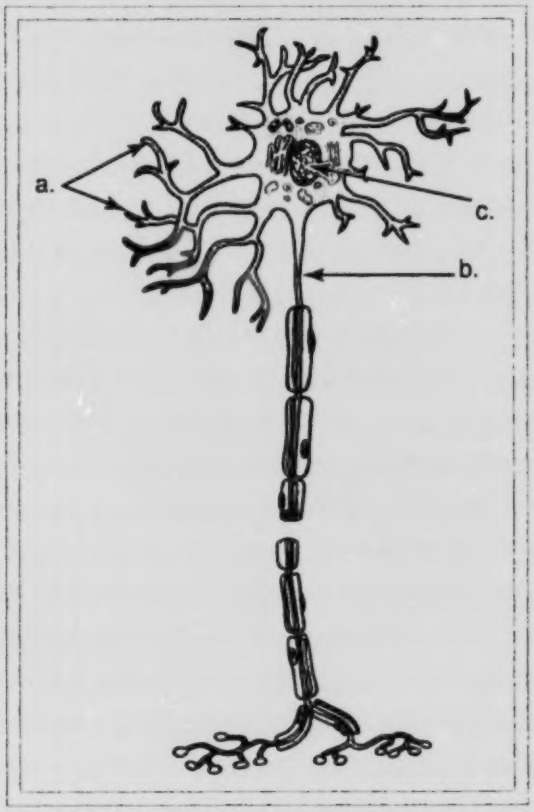
b. Dendrite _____

_____

c. Axon _____

_____

Objective 9 Label the major structures of a neuron. Write your answers on the blank lines provided below the following illustration.



a. _____ b. _____ c. _____

Objective 10 Define the term *nerve fiber*. Write your answer on the blank lines provided beside the term below.

Nerve fiber _____

_____

OBJECTIVE 11

Define the major structures of a nerve fiber. Write your answers on the blank lines provided beside each of the terms below.

a. Axis cylinder _____

_____

b. Myelin sheath _____

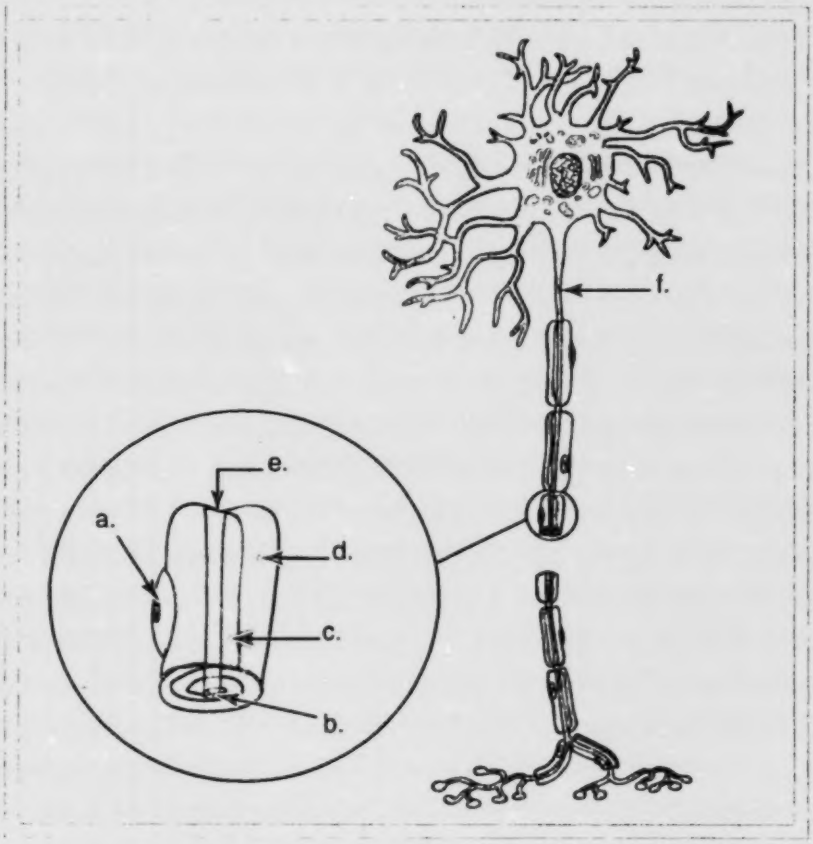
_____

c. Neurilemma _____

_____

OBJECTIVE 12

Label the major structures of a nerve fiber. Write your answers on the blank lines provided below the following illustration.



a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

OBJECTIVE 13

Match types of neurons to their correct descriptions. Write the numbers on the blanks. Numbers will be used more than once.

1. Sensory neurons 2. Interneurons 3. Motor neurons

_____ a. Are controlled by the frontal lobe of the brain

_____ b. Conduct messages or impulses from sensory to motor neurons

_____ c. Transmit messages from the central nervous system to all parts of the body

_____ d. Are also called *afferent* or *receptor neurons*

_____ e. Are found only in the central nervous system (brain and spinal cord)

_____ f. Are controlled by the thalamus

_____ g. Are located in the muscles and glands

_____ h. Are also called *central neurons* or *internuncial neurons* or *connecting neurons*

_____ i. Are also called *efferent neurons*

_____ j. Receive messages from all parts of the body and transmit them to the central nervous system (brain and spinal cord)

OBJECTIVE 14

Complete statements that describe the transmission of nerve impulses. Write your answers on the blank lines provided in the statements below.

a. When a neuron receives a signal, it sends an impulse on to the next neuron across the _____ between an axon and a dendrite.

b. Two or more _____ arranged in a chain function to conduct impulses from one place to another.

c. Impulses pass only in one direction from a receptor dendrite to the _____ to the axon to a _____ and so on.

d. When a nerve impulse is blocked, the blocking usually takes place at a _____.

Objective 15

Complete statements that describe a reflex arc. Write your answers on the blank lines provided in the statements below.

a. A reflex is an involuntary response to a _____, such as blinking the eyes when something approaches them, salivating at the sight of appetizing food, and jerking of the knee when a certain spot is tapped.

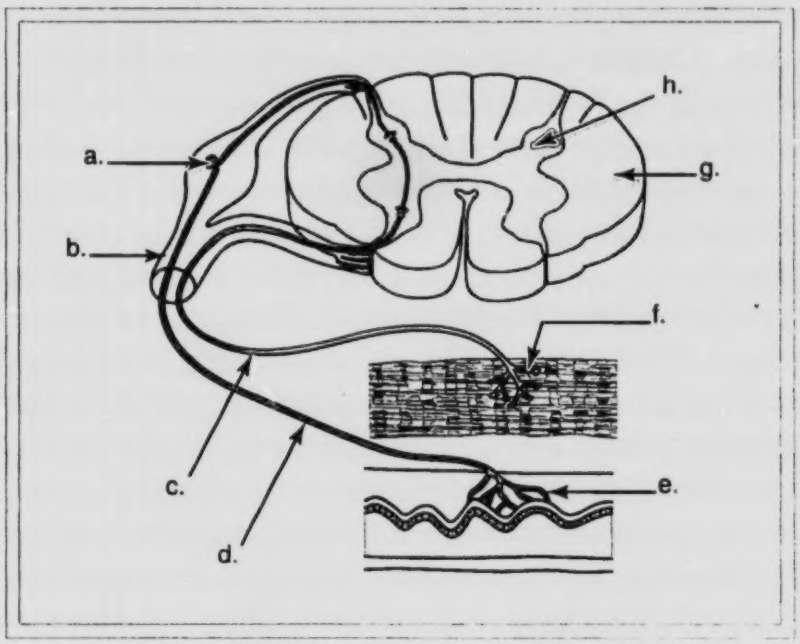
b. Many reflexes do not involve action on part of the brain; instead, the affector/effector circuit is completed by a loop in the spinal cord called a _____.

c. A _____ consists of an affector that provides a signal through a sensory neuron into a spinal nerve and into the spinal cord.

d. The impulse passes through an interneuron in the _____ of the spinal cord to a motor neuron that connects to an effector.

Objective 16

Label the major structures of a reflex arc. Write your answers on the blank lines provided below the following illustration.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____ h. _____

Objective 17 Describe the stages in the regeneration of a peripheral nerve. Write your answers on the blank lines provided below.

a. Stage 1 _____

_____

b. Stage 2 _____

_____

c. Stage 3 _____

_____

Objective 18 State the functions of the types of neuroglia. Write your answers on the blank lines provided beside each of the terms below.

a. Oligodendrocytes _____

_____

b. Microglia _____

_____

c. Astrocytes _____

_____

d. Ependyma _____

_____

Objective 19 List the major structures within the spinal canal. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

Objective 20 Complete statements that describe the structure and functioning of the spinal cord. Write your answers on the blank lines provided in the statements below and on the next page.

a. The spinal cord is a small cord about _____ inches long in an adult.

b. The spinal cord lies within the _____ and is surrounded by the vertebrae.

c. The spinal cord acts as the conduction pathway for impulses between the _____ nerves to and from the brain.

d. In cross-section, the spinal cord exhibits an H-shaped area of _____ surrounded by an outer region of _____.

e. Spinal nerves emerge from the spinal cord as two short roots—the _____ root for the sensory nerves and the _____ root for the motor nerves.

f. The spinal cord extends from the _____ of the brain to the first lumbar vertebra or top of the second lumbar vertebra, where it begins to taper into a horsetail of fibers that finally ends in the _____ area.

Objective 21 State the function of cerebrospinal fluid. Write your answer on the blank lines provided below.

_____

_____

Objective 22 List the components of cerebrospinal fluid. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

Objective 23 Define the major structures of the meninges. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Dura mater _____

_____

b. Subdural space _____

_____

c. Arachnoid _____

_____

d. Subarachnoid space _____

_____

e. Pia mater _____

_____

OBJECTIVE 24 Define the primary divisions of the brain. Write your answers on the blank lines provided beside each of the terms below.

a. Forebrain _____

_____

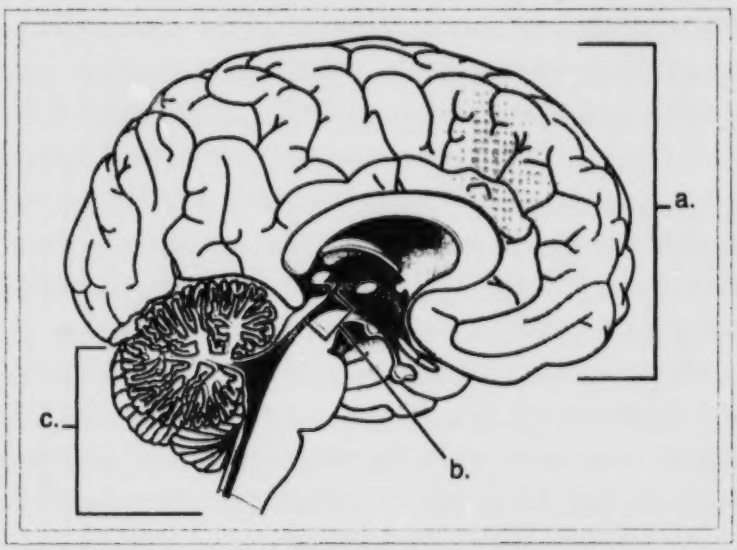
b. Midbrain _____

_____

c. Hindbrain _____

_____

OBJECTIVE 25 Label the primary divisions of the brain. Write your answers on the blank lines provided below the following illustration.



a. _____

b. _____

c. _____

Objective 26

Define the major structures of the forebrain (prosencephalon) and the hindbrain (rhombencephalon). Write your answers on the blank lines provided beside each of the terms below.

a. Cerebrum _____

b. Diencephalon _____

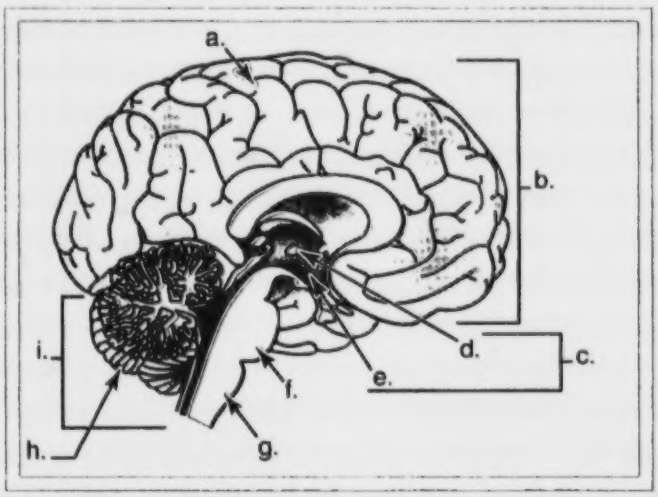
c. Cerebellum _____

d. Medulla oblongata _____

e. Pons _____

Objective 27

Label the major structures of the forebrain (prosencephalon) and the hindbrain (rhombencephalon). Write your answers on the blank lines provided below the following illustration.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____

Objective 28

Define the terms *hemisphere*, *sulcus*, *fissure*, *lobe*, and *ventricle*. Write your answers on the blank lines provided beside each of the terms below.

a. Hemisphere _____

_____

b. Sulcus _____

_____

c. Fissure _____

_____

d. Lobe _____

_____

e. Ventricle _____

_____

OBJECTIVE 29

Define the lobes of the cerebrum. Write your answers on the blank lines provided beside each of the terms below.

a. Frontal lobe _____

b. Parietal lobe _____

c. Occipital lobe _____

d. Temporal lobe _____

e. Central lobe _____

OBJECTIVE 30

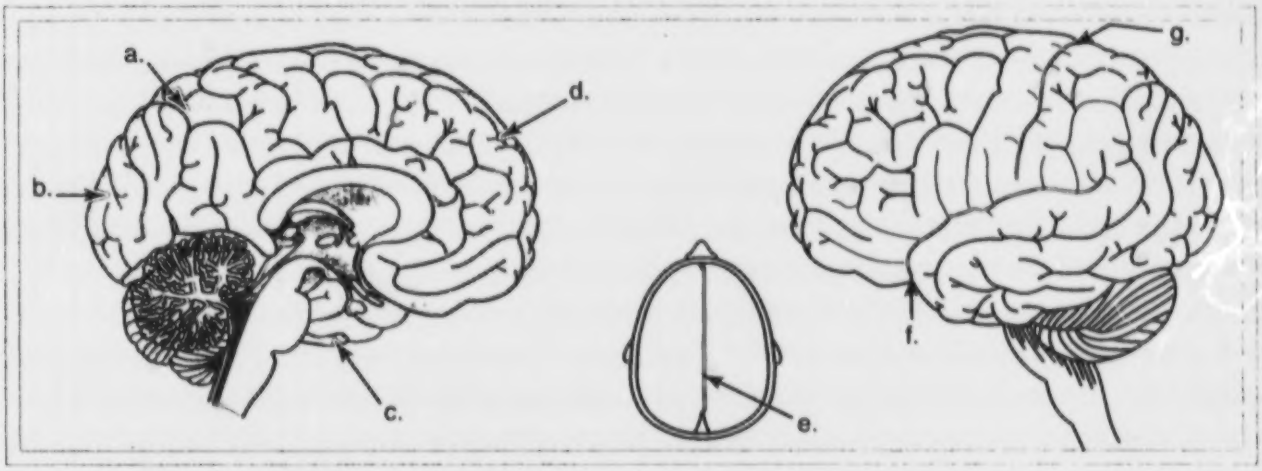
Define the fissures of the cerebrum. Write your answers on the blank lines provided beside each of the terms below.

a. Longitudinal fissure _____

b. Central fissure _____

c. Lateral fissure _____

Objective 31 Label the visible lobes and fissures of the cerebrum. Write your answers on the blank lines provided below the following illustration.



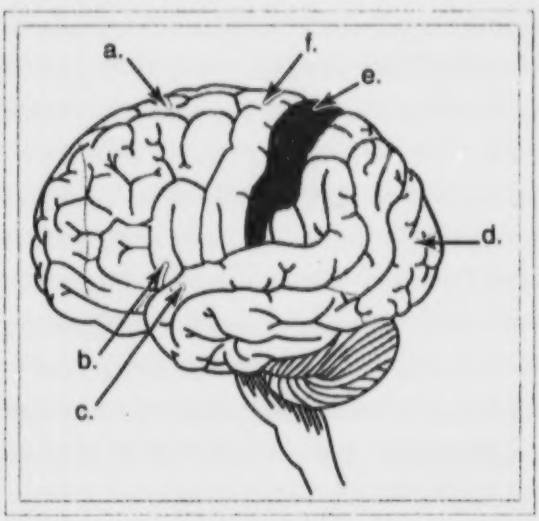
a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____

Objective 32 Label the functional areas of the brain. Write your answers on the blank lines provided below the following illustration.



a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

OBJECTIVE 33

Complete statements that describe the structure and functioning of the ventricles of the brain. Write your answers on the blank lines provided in the statements below.

a. There are four ventricles in the brain: two lateral ventricles and the _____ and _____ ventricles.

b. The ventricles are filled with _____ fluid.

c. The ventricles are continuous with the _____ of the spinal cord.

d. The lateral ventricles are located inside the _____.

e. Each _____ ventricle possesses a posterior, anterior, and inferior horn.

f. The posterior horn of the ventricle extends into the _____ lobe.

g. The anterior horn of the ventricle extends into the _____ lobe.

h. The inferior horn of the ventricle extends into the _____ lobe.

i. Each lateral ventricle communicates with the third ventricle by way of the _____.

j. The third ventricle is located in the _____ with the thalamus and hypothalamus.

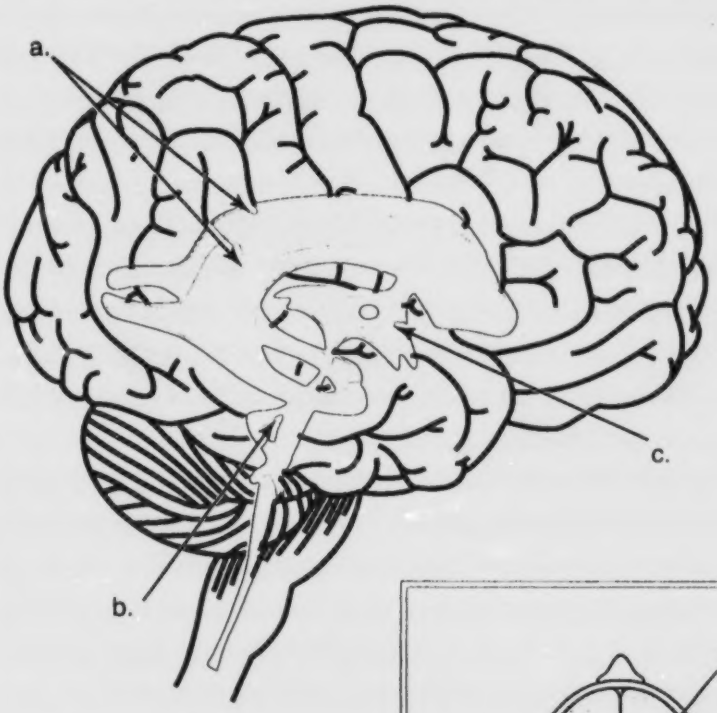
k. The _____ connects the third ventricle with the fourth ventricle.

l. The fourth ventricle lies between the _____ and the pons and the medulla.

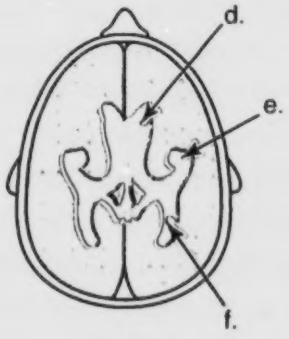
m. The fourth ventricle communicates with the _____ of the spinal canal through one medial foramen and two lateral foramina.

n. Inside each ventricle are tiny masses of specialized capillaries called _____ that secrete cerebrospinal fluid.

Objective 34 Label the ventricles of the brain and the horns of the lateral ventricles. Write your answers on the blank lines provided below the following illustration.



Ventricles of the brain



Horns of the lateral ventricles

a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

OBJECTIVE 35

State the number and functions of the cranial nerves of the peripheral nervous system. Write your answers on the blank lines provided beside each of the terms below.

a. Auditory _____

_____

b. Hypoglossal _____

_____

c. Trigeminal _____

_____

d. Facial _____

_____

e. Glossopharyngeal _____

_____

f. Optic _____

_____

g. Trochlear _____

_____

h. Spinal accessory _____

_____

i. Oculomotor _____

_____

j. Olfactory _____

_____

k. Abducens _____

_____

l. Vagus _____

_____

OBJECTIVE 36

Define the term *plexus*. Write your answer on the blank lines provided beside the term below.

Plexus _____

_____

Objective 38 Describe the number and origin of the spinal nerves. Write your answers on the blank lines provided beside each of the terms below.

a. Cervical nerves _____

_____

b. Thoracic nerves _____

_____

c. Lumbar nerves _____

_____

d. Sacral nerves _____

_____

e. Coccygeal nerves _____

_____

Objective 39 List the major nerves that arise from each plexus. Write your answers on the blank lines provided below and on the next page.

Major nerves that arise from the cervical plexus

a. _____ b. _____

Major nerves that arise from the brachial plexus

c. _____ f. _____

d. _____ g. _____

e. _____ h. _____

Major nerves that arise from the lumbar plexus

i. _____ j. _____

Major nerves that arise from the sacral plexus

k. _____ m. _____

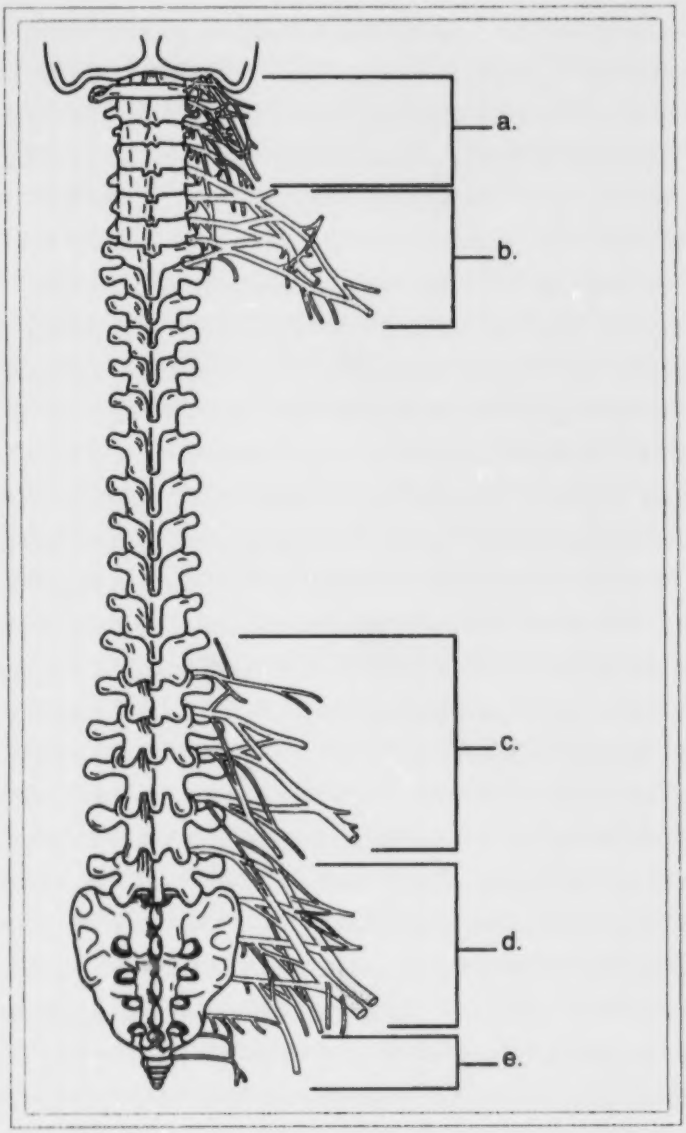
l. _____

Major nerves that arise from the coccygeal plexus

n. _____ o. _____

OBJECTIVE 37

Label the plexuses of the spinal cord. Write your answers on the blank lines provided below the following illustration.



a. _____ d. _____

b. _____ e. _____

c. _____

OBJECTIVE 40

Match common disorders and abnormalities of the nervous system to their correct definitions. Write the numbers on the blanks.

_____ a. An inherited disease that produces numerous benign tumors in the Schwann cells of the nerve cells of the skin

_____ b. A generally benign tumor arising from neuroglia

_____ c. A condition of recurring pain as a result of disease or injury in the trigeminal (C5) nerve

_____ d. A condition of recurring or chronic seizures

_____ e. An inflammation of the meninges usually caused by a bacterial infection

_____ f. A disability that results from injury before or during birth that leads to poor muscle coordination and speech disturbances

_____ g. A degenerative condition in neurons that leads to overstimulation of skeletal muscles, marked by tremor and weakness of resting muscles and by a shuffling gait

_____ h. A tumor that develops from the eighth cranial (auditory) nerve and grows within the auditory canal

_____ i. An increase in the amount of cerebrospinal fluid in the cranial cavity, resulting in an enlargement of the skull and especially the forehead and atrophy of the brain

_____ j. A tumor that arises in the lining of a ventricle and may extend to the spinal cord

_____ k. The general term for any tumor arising from a nerve and usually consisting of nerve fiber

_____ l. A tumor that occurs in astrocytes

_____ m. An inherited disease that leads to involuntary, purposeless movements

_____ n. A lesion in the brain; a stroke

_____ o. A progressive nerve disorder that leads to degeneration of the myelin sheaths of CNS nerve cells, is marked by patches of hardened tissue in the brain or the spinal cord, and is associated with partial or complete paralysis and jerking muscle tremor

_____ p. A progressive disease of the central nervous system that results in loss of memory and reduced intellectual ability and speech and motor control

_____ q. A viral infection of the sensory fibers in the skin, causing a painful eruption of red patches

1. Acoustic neuroma
2. Alzheimer's disease
3. Astrocytoma
4. Cerebral palsy
5. Cerebrovascular accident
6. Ependymoma
7. Epilepsy
8. Glioma
9. Herpes zoster
10. Huntington's disease
11. Hydrocephalus
12. Meningitis
13. Multiple neurofibromatosis
14. Multiple sclerosis
15. Neuroma
16. Parkinson's disease
17. Trigeminal neuralgia

Answers to Written Test

Objective 1

The extensive intricate network of structures that activates, coordinates, and controls all of the functions of the body

Objective 2

Answers may appear in any order.

a. Receives internal and external stimuli through the sensory organs

b. Transmits messages to and from the brain

c. Interprets the transmitted messages, stores any needed information, and coordinates any required responses

d. Responds to internal and external stimuli through the motor organs

Objective 3

a. The part of the nervous system that consists of the brain and spinal cord, to which sensory impulses are transmitted and from which motor impulses pass out; the part of the nervous system that coordinates the activity of the entire nervous system

b. The part of the nervous system that is outside the central nervous system and consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves that link the various parts of the body to the central nervous system

Objective 4

a. The part of the peripheral nervous system that connects the central nervous system to the skin and the skeletal muscles via the cranial and spinal nerves and initiates voluntary responses

b. The part of the peripheral nervous system that connects the central nervous system to the visceral organs via the cranial and spinal nerves and initiates involuntary responses

Objective 5

a. The part of the autonomic nervous system that prepares the body to deal with emergencies through the expenditures of energy

b. The part of the autonomic nervous system that restores homeostatic balance and conserves energy

Objective 6

Tissue consisting of one or more bundles of impulse-carrying fibers that connect the brain and the spinal cord with other parts of the body

Objective 7

a. The basic nerve-tissue cells that are capable of transmitting nerve impulses

b. The basic nerve-tissue cells that support neurons and play a role when there is injury or infection in the nervous system

Objective 8

a. Acts as a sending and receiving center, performs metabolic and reproductive functions for the cell, and stores energy

b. Carries impulses to the cell body

c. Carries impulses from the cell body

Objective 9

a. Dendrites
b. Axon
c. Cell body

Objective 10

An elongated process of a neuron—usually the axon—concerned primarily with the conduction of impulses

Objective 11

a. The central core of a nerve fiber that consists of a jelly-like material

b. The segmented, fatty covering of a nerve fiber that wraps the axons of many nerves and acts as an electrical insulator that reduces the possiblity of an impulse stimulating adjacent nerves

c. The layer of cells composed of one or more Schwann cells that enclose the myelin sheath; the cell nucleus is a flattened oval that lies in a small depression in the myelin

Objective 12

a. Nucleus of Schwann cell
b. Axis cylinder
c. Myelin sheath
d. Neurilemma
e. Axis cylinder
f. Axon

Objective 13

a. 3	c. 3	e. 2	g. 3	i. 3
b. 2	d. 1	f. 1	h. 2	j. 1

Objective 14

a. synapse
b. neurons
c. cell body; dendrite
d. synapse

Objective 15

a. stimulus
b. reflex arc
c. reflex arc
d. gray matter

Objective 16

a. Cell body
b. Spinal nerve
c. Motor nerve
d. Sensory neuron
e. Affector
f. Effector
g. White matter
h. Gray matter

Objective 17

a. The part of the nerve fiber that is separated by injury or disease from the cell body disintegrates.

b. The neurilemma starts to regenerate at the site of the injury; if the cut ends of the neurilemma are not separated by too much distance, the sections grow back together to form a neurilemmar tube.

c. The axon stump that is attached to the cell body grows into the neurilemmar tube and the regeneration is complete.

Objective 18

a. Form the insulating sheath of myelin on neurons in the central nervous system

b. Move so that they can locate and destroy damaged tissue and invading cells and organisms

c. Prevent harmful chemicals from entering the brain from contaminated blood

d. Line the fluid-filled cavities in the brain and help to circulate cerebrospinal fluid

Objective 19

Answers may appear in any order.

a. Spinal cord
b. Cerebrospinal fluid
c. Meninges
d. Adipose tissue
e. Blood vessels

Objective 20

a. 18
b. spinal canal
c. peripheral
d. gray matter; white matter
e. dorsal; ventral
f. medulla; coccygeal

Objective 21

Circulates around the brain and spinal cord to maintain an even pressure and act as a cushion or shock absorber

Objective 22

Answers may appear in any order.

a. Water
b. Glucose
c. Sodium chloride
d. Protein
e. Some waste products, such as urea

Objective 23

a. The hard, outermost protective layer of the meninges that is composed of connective tissue

b. The cavity beneath the dura mater that is filled with serous fluid

c. The middle layer of the meninges that resembles a spider's web

d. The cavity below the arachnoid that is filled with cerebrospinal fluid and acts as a shock absorber for the spinal cord and the brain

e. The soft, innermost layer of the meninges that contains blood vessels that nourish the tissue layers and carry away waste products

Objective 24

a. The prosencephalon; the anterior division of the brain
b. The mesencephalon; the middle division of the brain
c. The rhombencephalon; the posterior division of the brain

Objective 25

a. Forebrain (prosencephalon)
b. Midbrain (mesencephalon)
c. Hindbrain (rhombencephalon)

Objective 26

a. The telencephalon; the anterior portion of the brain that is considered to be the seat of conscious mental processes

b. The posterior subdivision of the forebrain that includes the thalamus, which serves as a relay center and functions in the integration of sensory information, and the hypothalamus, which controls body temperature, water balance, sleep, appetite, some emotions, and both divisions of the autonomic nervous system

c. The posterior portion of the hindbrain that serves to maintain body balance, equilibrium, coordination, and muscle tone

d. The portion of the hindbrain that is continuous posteriorly with the spinal cord and serves to control vital functions such as breathing, heart rate, blood pressure, swallowing, and coughing

e. The portion of the hindbrain that is at the anterior end of the medulla oblongata and serves to relay impulses between the cerebrum and the cerebellum and the cerebrum and the medulla oblongata

Objective 27

a. Cerebrum (telencephalon)
b. Forebrain (prosencephalon)
c. Diencephalon
d. Thalamus
e. Hypothalamus
f. Pons
g. Medulla oblongata
h. Cerebrum
i. Hindbrain (rhombencephalon)

Objective 28

a. One half of a sphere; the lateral half of the cerebrum or cerebellum
b. A shallow groove, a depression, or a furrow on the surface of an organ
c. A cleft or a groove on the surface of an organ, marking division of the organ into parts
d. A portion of any organ that is demarcated by sulci, fissures, or connective tissue
e. A small cavity, such as the cavities filled with cerebrospinal fluid in the brain

Objective 29

a. The anterior division of each cerebral hemisphere that controls voluntary muscles and judgment

b. The middle division of each cerebral hemisphere that controls sensory functions such as pain, touch, and temperature interpretation

c. The posterior lobe of each cerebral hemisphere that controls vision

d. A large lobe of each cerebral hemisphere that is situated in front of the occipital lobe and controls hearing, smell, and taste

e. One of the lobes constituting each of the cerebral hemispheres and lying hidden in the depths of the lateral sulcus

Objective 30

a. The fissure that divides the cerebrum into two hemispheres
b. The fissure that divides the frontal lobe laterally from the parietal lobe
c. The fissure that separates the temporal lobe from the parietal lobe

Objective 31

a. Parietal lobe
b. Occipital lobe
c. Temporal lobe
d. Frontal lobe
e. Longitudinal fissure
f. Lateral fissure
g. Central fissure

Objective 32

a. Premotor area
b. Motor-speech area
c. Auditory-association and auditory-sense area
d. Visual area
e. General sensory area
f. Motor area

Objective 33

a. third; fourth
b. cerebrospinal
c. central canal
d. cerebral hemispheres
e. lateral
f. occipital
g. frontal
h. temporal
i. interventricular foramen
j. diencephalon
k. cerebral aqueduct
l. cerebellum
m. subarachnoid space
n. choroid plexuses

Objective 34

a. Lateral ventricles
b. Fourth ventricle
c. Third ventricle
d. Anterior horn
e. Inferior horn
f. Posterior horn

Objective 35

a. Nerve pair VIII; support the sense of hearing and balance
b. Nerve pair XII; control the tongue muscles
c. Nerve pair V; control the muscles of the cornea and conjunctiva, the upper portion of the face, the ear, the lower lip, the teeth, the gums, and the muscles for chewing
d. Nerve pair VII; supply the face muscles, the middle ear, and the taste sensors
e. Nerve pair IX; support the sense of taste and control swallowing
f. Nerve pair II; support the sense of sight
g. Nerve pair IV; control some of the eye muscles
h. Nerve pair XI; control the muscles of the neck and upper back
i. Nerve pair III; control four muscles of the eye
j. Nerve pair I; support the sense of smell
k. Nerve pair VI; control lateral eye movement
l. Nerve pair X; control swallowing, hunger, speech, breathing, heart rate, peristalsis, and glands in the stomach and pancreas

Objective 36

A network of nerves from several segments of the spinal cord that combine to form nerves to specific parts of the body

Objective 37

a. Cervical plexus
b. Brachial plexus
c. Lumbar plexus
d. Sacral plexus
e. Coccygeal plexus

Objective 38

a. The eight pairs of spinal nerves that arise from the neck area of the spinal cord

b. The 12 pairs of spinal nerves on each side of the thorax, including 11 intercostal nerves and one subcostal nerve

c. The five pairs of spinal nerves that arise in the lumbar region of the spinal cord

d. The five pairs of spinal nerves that arise from the sacral region of the spinal cord

e. The single pair of spinal nerves that arises near the coccygeal region of the spinal cord

Objective 39

Answers may appear in any order in each section below.

Major nerves that arise from the cervical plexus
a. C-1 through C-4
b. Phrenic

Major nerves that arise from the brachial plexus
c. C-5 through C-8
d. T-1
e. Axillary nerve
f. Radial nerve
g. Median nerve
h. Ulnar nerve

Major nerves that arise from the lumbar plexus
i. L-1 through L-4
j. Femoral nerve

Major nerves that arise from the sacral plexus
k. L-4 and L-5
l. S-1 through S-4
m. Sciatic nerve

Major nerves that arise from the coccygeal plexus
n. S-4 and S-5
o. Coccygeal nerve

Objective 40

a. 13	e. 12	i. 11	m. 10	q. 9
b. 8	f. 4	j. 6	n. 5	
c. 17	g. 16	k. 15	o. 14	
d. 7	h. 1	l. 3	p. 2	

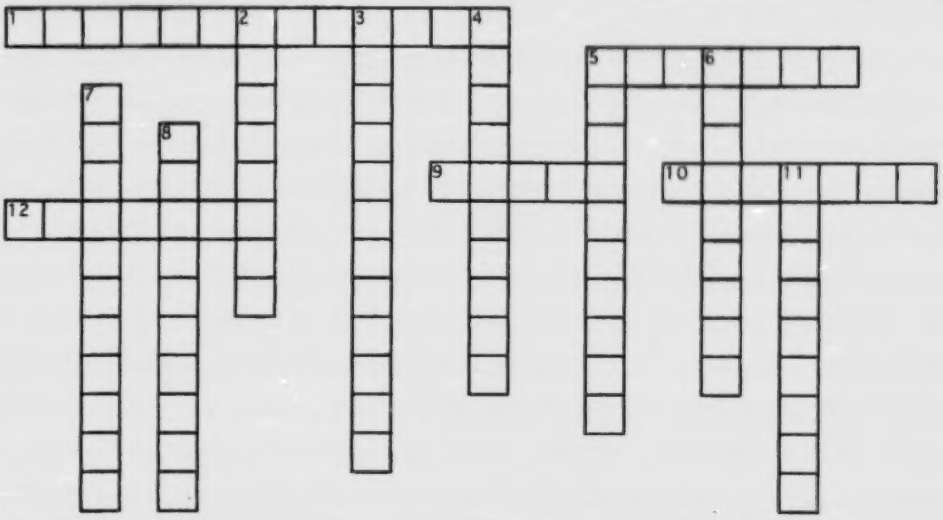
Answers to Assignment Sheet

Assignment Sheet 1

Answers must be evaluated to the instructor's satisfaction based on procedures assigned.

Crossword Puzzle 1—Terms from Objectives 1 Through 4

Name _____ Date _____



ACROSS

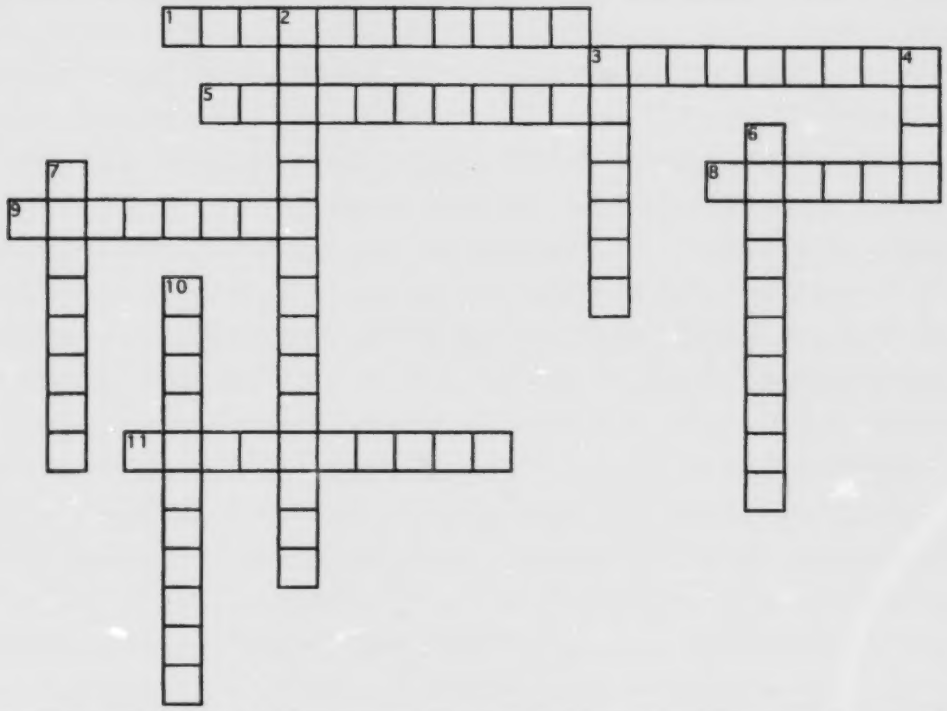
1. The extensive intricate network of structures that activates, coordinates, and controls all of the functions of the body (2 words)
5. The _____ nervous system; the part of the peripheral nervous system that connects the central nervous system to the skin and the skeletal muscles via the cranial and spinal nerves and initiates voluntary responses
9. The portion of the central nervous system contained within the cranium and containing specialized cells that coordinate and regulate the functions of the central nervous system
10. Of, relating to, or affecting the body
12. The _____ nervous system; the part of the nervous system that consists of the brain and spinal cord, to which sensory impulses are transmitted and from which motor impulses pass out; the part of the nervous system that coordinates the activity of the entire nervous system

DOWN

2. A change in an organism's external environment or internal conditions that cause a response in one or more of the organism's systems
3. An organ with the primary purpose of monitoring conditions in the environment and within the body in order to provide the brain with information that may require a response (2 words)
4. An organ with the primary function of moving materials within the body or parts of the body itself (2 words)
5. The cord of nerve tissue that extends from the brain lengthwise along the back in the spinal canal and gives off pairs of spinal nerves, carries impulses to and from the brain, and serves as a center for initiating and coordinating reflex acts (2 words)
6. The _____ nervous system; the part of the peripheral nervous system that connects the central nervous system to the visceral organs via the cranial and spinal nerves and initiates involuntary responses
7. The row of aligned holes in the vertebrae through which the spinal cord passes (2 words)
8. The _____ nervous system; the part of the nervous system that is outside the central nervous system and consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves that link the various parts of the body to the central nervous system
11. Acting or occurring involuntarily

Crossword Puzzle 2—Terms from Objectives 5 Through 10

Name _____ Date _____



ACROSS

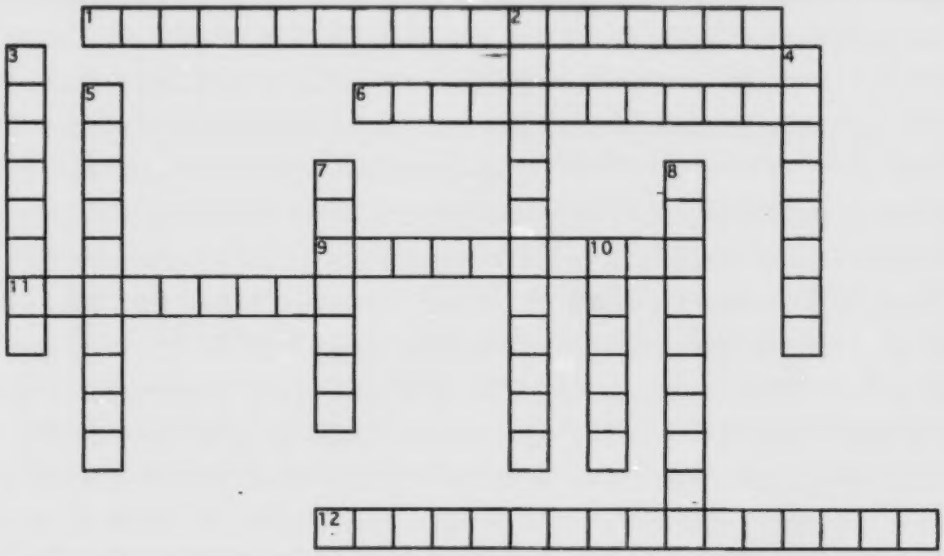
1. The _____ nervous system; the part of the autonomic nervous system that prepares the body to deal with emergencies through the expenditures of energy
3. The basic nerve-tissue cells that support neurons and play a role when there is injury or infection in the nervous system
5. Tissue consisting of one or more bundles of impulse-carrying fibers that connect the brain and the spinal cord with other parts of the body (2 words)
8. A soft, white, somewhat fatty material that forms a thick sheath about the core of a myelinated nerve fiber
9. The major structure of a neuron that acts as a sending and receiving center, performs metabolic and reproductive functions for the cell, and stores energy (2 words)
11. An elongated process of a neuron—usually the axon—concerned primarily with the conduction of impulses (2 words)

DOWN

2. The _____ nervous system; the part of the autonomic nervous system that restores homeostatic balance and conserves energy
3. The basic nerve-tissue cells that are capable of transmitting nerve impulses
4. The major structure of a neuron that carries impulses from the cell body
6. Having a myelin sheath
7. The major structure of a neuron that carries impulses to the cell body
10. Neural tissue that consists largely of myelinated nerve fiber and has a whitish color (2 words)

Crossword Puzzle 3—Terms from Objectives 11 Through 19

Name _____ Date _____



ACROSS

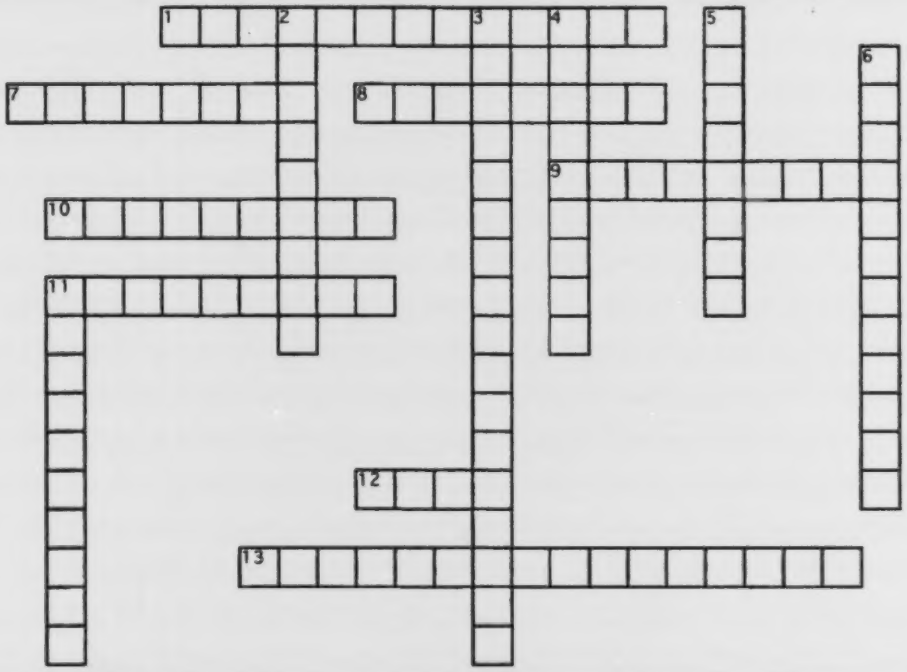
1. The tissue fluid that circulates around the brain and spinal cord (2 words)
6. The segmented, fatty covering of a nerve fiber that wraps the axons of many nerves and acts as an electrical insulator that reduces the possibility of an impulse stimulating adjacent nerves (2 words)
9. The layer of cells composed of one or more Schwann cells that enclose the myelin sheath; the cell nucleus is a flattened oval that lies in a small depression in the myelin
11. Types of neuroglia that move so that they can locate and destroy damaged tissue and invading cells and organisms
12. Types of neuroglia that form the insulating sheath of myelin on neurons in the central nervous system

DOWN

2. The central core of a nerve fiber that consists of a jelly-like material (2 words)
3. Types of neuroglia that line the fluid-filled cavities in the brain and help to circulate cerebrospinal fluid
4. One of a pair of large oval organs in the brain
5. Types of neuroglia that prevent harmful chemicals from entering the brain from contaminated blood
7. The space between the axon and the dendrites of adjoining neurons through which nerve impulses travel
8. Nerve tissue that consists of motor neurons and interneurons (2 words)
10. Any one of the three membranes that envelop the brain and the spinal cord

Crossword Puzzle 4—Terms from Objectives 20 Through 26

Name _____ Date _____



ACROSS

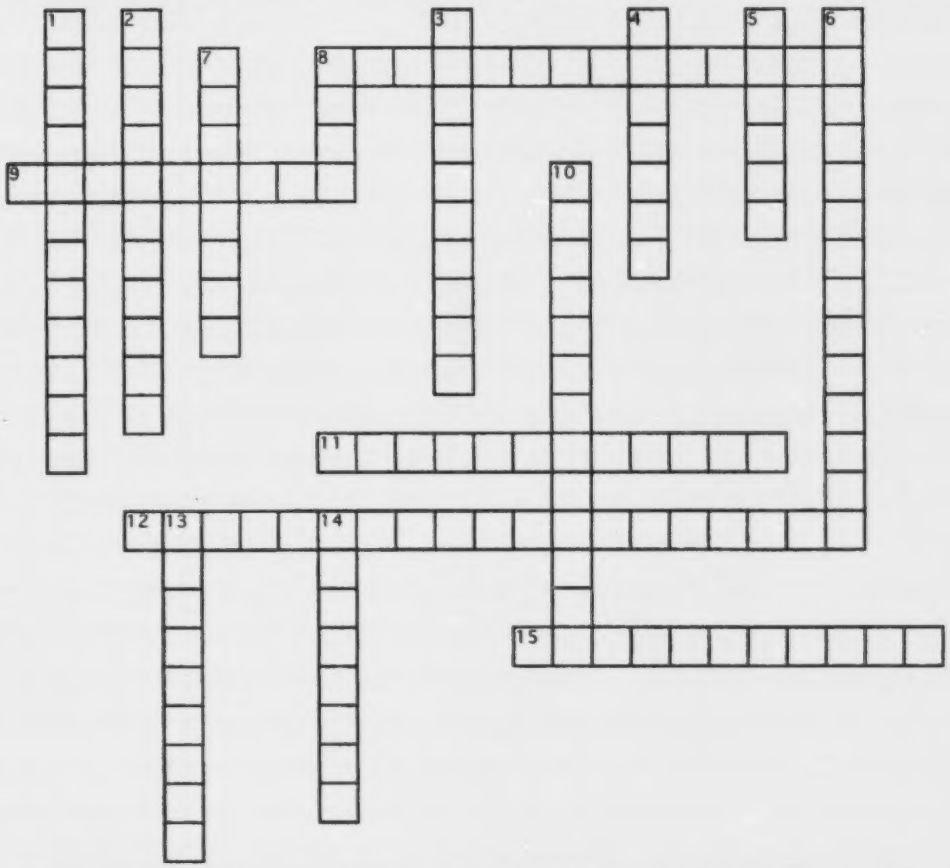
1. The cavity beneath the dura mater that is filled with serous fluid (2 words)
7. The soft, innermost layer of the meninges that contains blood vessels that nourish the tissue layers and carry away waste products (2 words)
8. The mesencephalon; the middle division of the brain
9. The rhombencephalon; the posterior division of the brain
10. The prosencephalon; the anterior division of the brain
11. Of or relating to the coccyx, the four fused vertebrae that form the terminus of the spinal column
12. The portion of the hindbrain that is at the anterior end of the medulla oblongata and serves to relay impulses between the cerebrum and the cerebellum and the cerebrum and the medulla oblongata
13. The portion of the hindbrain that is continuous posteriorly with the spinal cord and serves to control vital functions such as breathing, heart rate, blood pressure, swallowing, and coughing (2 words)

DOWN

2. The hard, outermost protective layer of the meninges that is composed of connective tissue (2 words)
3. The cavity below the arachnoid that is filled with cerebrospinal fluid and acts as a shock absorber for the spinal cord and the brain (2 words)
4. The middle layer of the meninges that resembles a spider's web
5. The telencephalon; the anterior portion of the brain that is considered to be the seat of conscious mental processes
6. The posterior subdivision of the forebrain that includes the thalamus, which serves as a relay center and functions in the integration of sensory information, and the hypothalamus, which controls body temperature, water balance, sleep, appetite, some emotions, and both divisions of the autonomic nervous system
11. The posterior portion of the hindbrain that serves to maintain body balance, equilibrium, coordination, and muscle tone

Crossword Puzzle 5—Terms from Objectives 28 Through 30

Name _____ Date _____



ACROSS

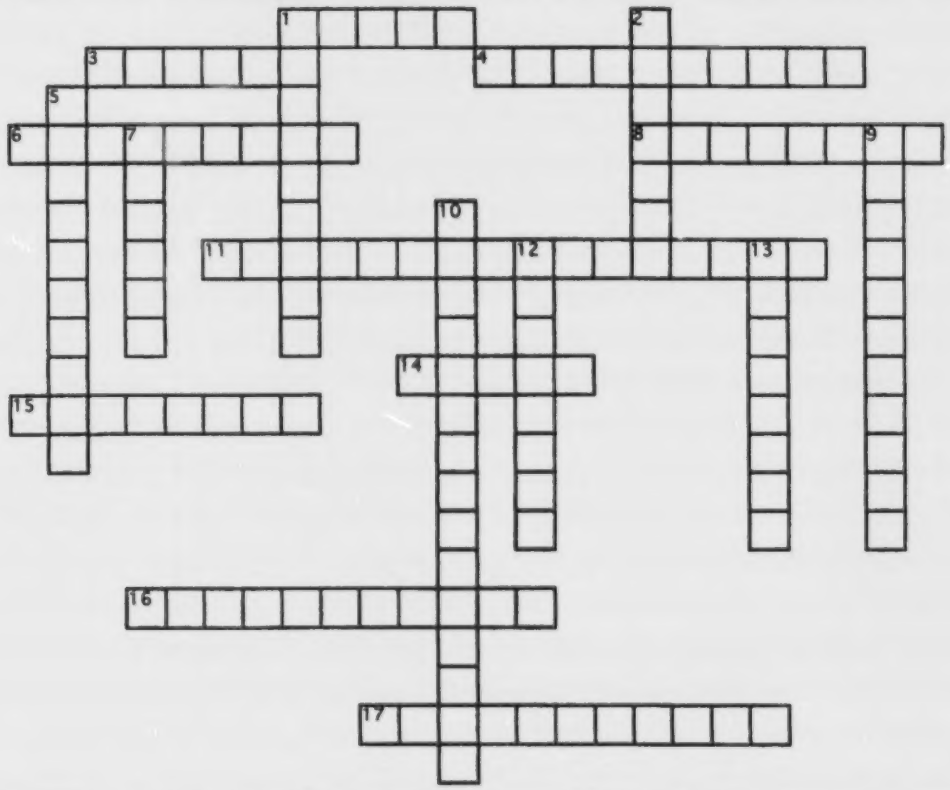
8. The fissure of the cerebrum that separates the temporal lobe from the parietal lobe (2 words)
9. A small cavity, such as the cavities filled with cerebrospinal fluid in the brain
11. A large lobe of each cerebral hemisphere that is situated in front of the occipital lobe and controls hearing, smell, and taste (2 words)
12. The fissure of the cerebrum that divides the cerebrum into two hemispheres (2 words)
15. One of the lobes constituting each of the cerebral hemispheres and lying hidden in the depths of the lateral sulcus (2 words)

DOWN

1. The middle division of each cerebral hemisphere that controls sensory functions such as pain, touch, and temperature interpretation (2 words)
2. The anterior division of each cerebral hemisphere that controls voluntary muscles and judgment (2 words)
3. One half of a sphere; the lateral half of the cerebrum or cerebellum
4. A cleft or a groove on the surface of an organ, marking division of the organ into parts
5. A shallow groove, a depression, or a furrow on the surface of an organ
6. The fissure of the cerebrum that divides the frontal lobe laterally from the parietal lobe (2 words)
7. Of, relating to, or forming the upper posterior wall of the head
8. A portion of any organ that is demarcated by sulci, fissures, or connective tissue
10. The posterior lobe of each cerebral hemisphere that controls vision (2 words)
13. Of, relating to, or located within or near the occiput or the occipital bone
14. Of or relating to the temples or the sides of the skull behind the orbits

Crossword Puzzle 6—Terms from Objectives 33 Through 35

Name _____ Date _____



ACROSS

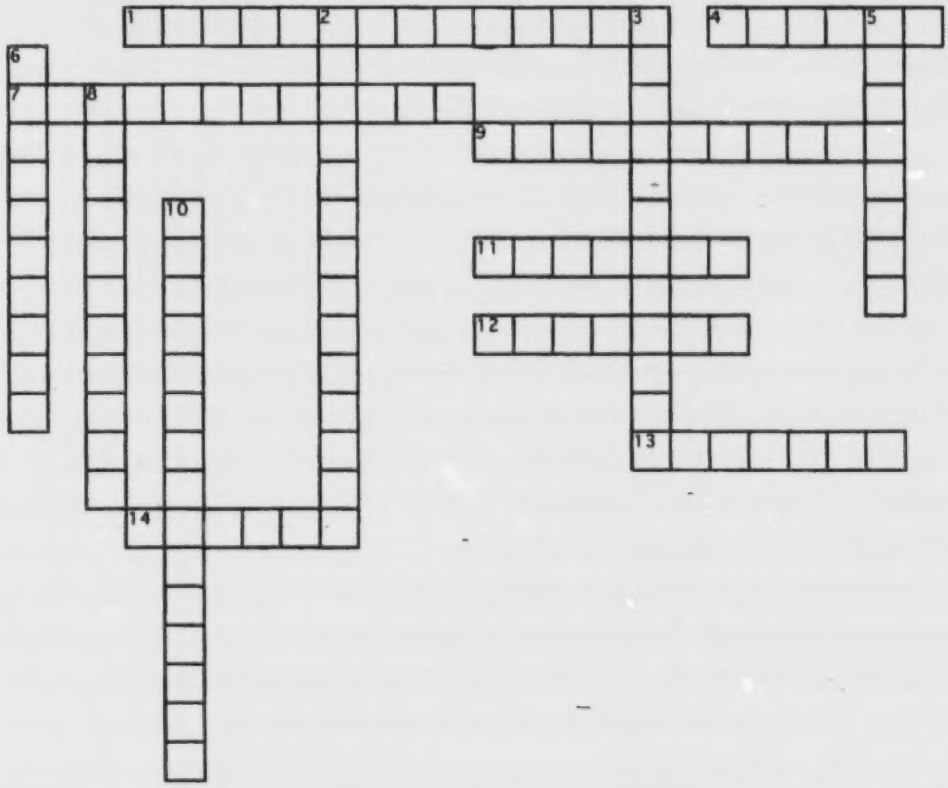
1. Nerve pair II; support the sense of sight
3. Nerve pair VII; supply the face muscles, the middle ear, and the taste sensors
4. Nerve pair III; control four muscles of the eye
6. Nerve pair IV; control some of the eye muscles
8. A canal or passage in a part or organ
11. Nerve pair IX; support the sense of taste and control swallowing
14. Nerve pair X; control swallowing, hunger, speech, breathing, heart rate, peristalsis, and glands in the stomach and pancreas
15. A large gland that secretes digestive enzymes and the hormones insulin and glucagon
16. Nerve pair XII; control the tongue muscles
17. Successive waves of involuntary contractions that pass along the walls of a hollow muscular structure, such as the esophagus or the intestine, and force the contents onward

DOWN

1. Nerve pair I; support the sense of smell
2. An opening in a membranous structure
5. Nerve pair V; control the muscles of the cornea and conjunctiva, the upper portion of the face, the ear, the lower lip, the teeth, the gums, and the muscles for chewing
7. The transparent part of the coat of the eyeball that covers the iris and pupil and admits light to the interior
9. The mucous membrane that lines the inner surface of the eyelids and continues over the forepart of the eyeball
10. Nerve pair XI; control the muscles of the neck and upper back
12. Nerve pair VI; control lateral eye movement
13. Nerve pair VIII; support the sense of hearing and balance

Crossword Puzzle 7—Terms from Objectives 36 Through 39

Name _____ Date _____



ACROSS

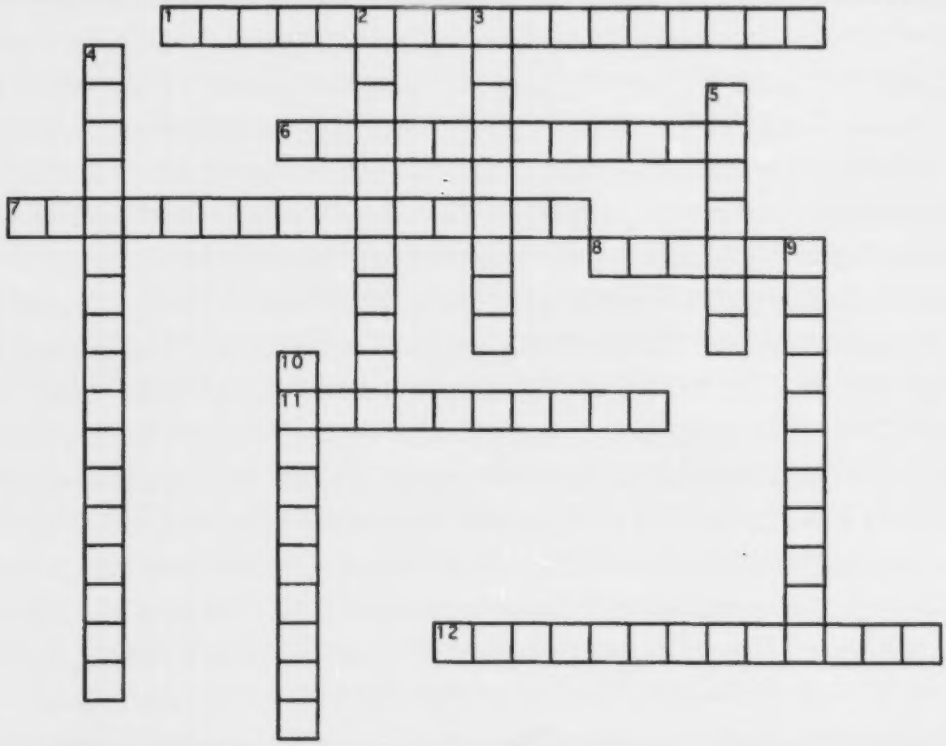
1. The 12 pairs of spinal nerves on each side of the thorax, including 11 intercostal nerves and one subcostal nerve (2 words)
4. Pertaining to the radius, one of the bones of the forearm, lying parallel to the ulna
7. The five pairs of spinal nerves that arise in the lumbar region of the spinal cord (2 words)
9. Of or pertaining to the space between two ribs
11. Of or relating to the diaphragm
12. Of or pertaining to the femur or thigh
13. Near the ischium, the hipbone
14. A network of nerves from several segments of the spinal cord that combine to form nerves to specific parts of the body

DOWN

2. The eight pairs of spinal nerves that arise from the neck area of the spinal cord (2 words)
3. The five pairs of spinal nerves that arise from the sacral region of the spinal cord (2 words)
5. Of or pertaining to the axilla, the cavity beneath the junction of the forelimb and the body
6. The nerve that supplies the muscles on the ulnar side of the forearm and hand (2 words)
8. The nerve that extends along the radial portions of the forearm and the hand and supplies various muscles and the skin of these parts (2 words)
10. The single pair of spinal nerves that arises near the coccygeal region of the spinal cord (2 words)

Crossword Puzzle 8—Terms from Objective 40

Name _____ Date _____



ACROSS

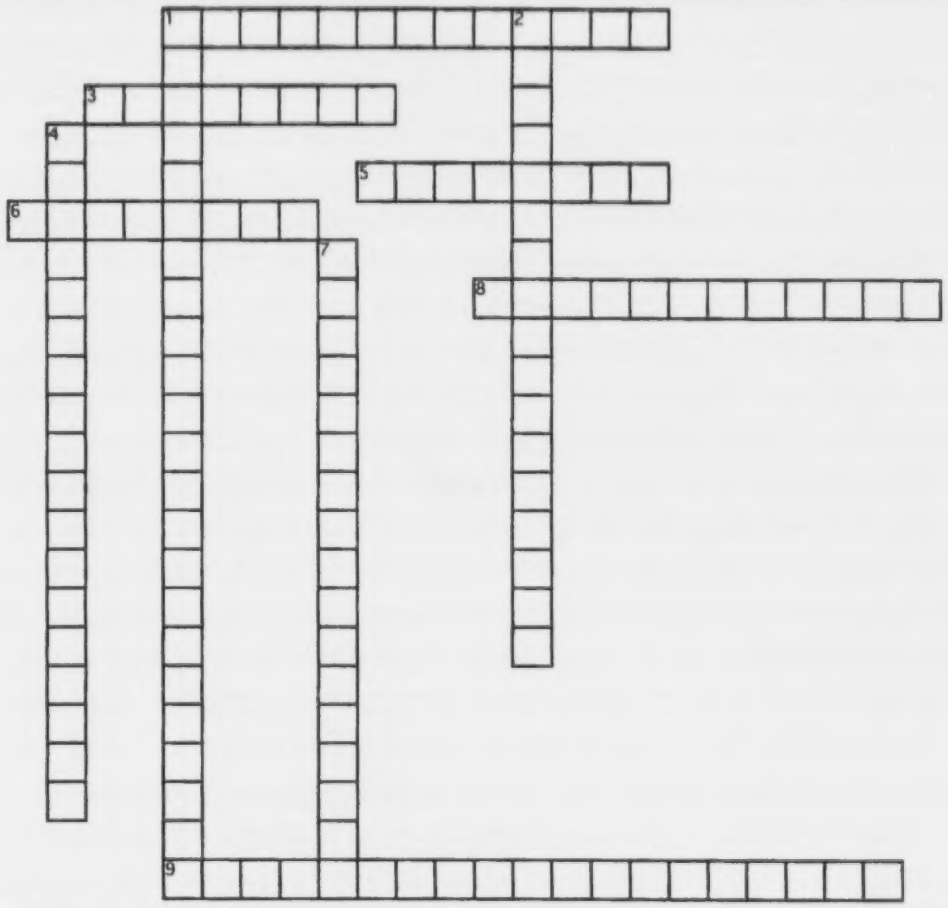
1. A progressive nerve disorder that leads to degeneration of the myelin sheaths of CNS nerve cells, is marked by patches of hardened tissue in the brain or the spinal cord, and is associated with partial or complete paralysis and jerking muscle tremor (2 words)
6. Worsening
7. A tumor that develops from the eighth cranial (auditory) nerve and grows within the auditory canal (2 words)
8. A generally benign tumor arising from neuroglia
11. A tumor that arises in the lining of a ventricle and may extend to the spinal cord
12. An increase in the amount of cerebrospinal fluid in the cranial cavity, resulting in an enlargement of the skull and especially the forehead and atrophy of the brain

DOWN

2. Becoming more involved
3. Any pathological hardening of tissue
4. Multiple _____ is an inherited disease that produces numerous benign tumors in the Schwann cells of the nerve cells of the skin
5. The general term for any tumor arising from a nerve and usually consisting of nerve fiber
9. A tumor that occurs in astrocytes
10. An inflammation of the meninges usually caused by a bacterial infection

Crossword Puzzle 9—Terms from Objectives 40 (cont.)

Name _____ Date _____



ACROSS

1. A disability that results from injury before or during birth that leads to poor muscle coordination and speech disturbances (2 words)
3. A blood clot that obstructs a blood vessel and can thereby prevent the flow of blood to a region of the body
5. A condition of recurring or chronic seizures
6. A weak spot in a blood vessel—generally an artery—that allows a bubble or sac to form in the wall of the vessel
8. A viral infection of the sensory fibers in the skin, causing a painful eruption of red patches (2 words)
9. A condition of recurring pain as a result of disease or injury in the trigeminal (C5) nerve (2 words)

DOWN

1. A lesion in the brain; a stroke (2 words)
2. A progressive disease of the central nervous system that results in loss of memory and reduced intellectual ability and speech and motor control (2 words)
4. An inherited disease that leads to involuntary, purposeless movements (2 words)
7. A degenerative condition in neurons that leads to overstimulation of skeletal muscles, marked by tremor and weakness of resting muscles and by a shuffling gait (2 words)

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. NERVOUS SYSTEM
5. SOMATIC
9. BRAIN
10. SOMATIC
12. CENTRAL

DOWN
2. STIMULUS
3. SENSORY ORGAN
4. MOTOR ORGAN
5. SPINAL CORD
6. AUTONOMIC
7. SPINAL CANAL
8. PERIPHERAL
11. AUTONOMIC

Crossword Puzzle 2

ACROSS
1. SYMPATHETIC
3. NEUROGLIA
5. NERVE TISSUE
8. MYELIN
9. CELL BODY
11. NERVE FIBER

DOWN
2. PARASYMPATHETIC
3. NEURONS
4. AXON
6. MYELINATED
7. DENDRITE
10. WHITE MATTER

Crossword Puzzle 3

ACROSS
1. CEREBROSPINAL FLUID
6. MYELIN SHEATH
9. NEURILEMMA
11. MICROGLIA
12. OLIGODENDROCYTES

DOWN
2. AXIS CYLINDER
3. EPENDYMA
4. THALAMUS
5. ASTROCYTES
7. SYNAPSE
8. GRAY MATTER
10. MENINX

Crossword Puzzle 4

ACROSS
1. SUBDURAL SPACE
7. PIA MATER
8. MIDBRAIN
9. HINDBRAIN
10. FOREBRAIN
11. COCCYGEAL
12. PONS
13. MEDULLA OBLONGATA

DOWN
2. DURA MATER
3. SUBARACHNOID SPACE
4. ARACHNOID
5. CEREBRUM
6. DIENCEPHALON
11. CEREBELLUM

Crossword Puzzle 5

ACROSS
8. LATERAL FISSURE
9. VENTRICLE
11. TEMPORAL LOBE
12. LONGITUDINAL FISSURE
15. CENTRAL LOBE

DOWN
1. PARIETAL LOBE
2. FRONTAL LOBE
3. HEMISPHERE
4. FISSURE
5. SULCUS
6. CENTRAL FISSURE
7. PARIETAL
8. LOBE
10. OCCIPITAL LOBE
13. OCCIPITAL
14. TEMPORAL

Crossword Puzzle 6

ACROSS
1. OPTIC
3. FACIAL
4. OCULOMOTOR
6. TROCHLEAR
8. AQUEDUCT
11. GLOSSOPHARYNGEAL
14. VAGUS
15. PANCREAS
16. HYPOGLOSSAL
17. PERISTALSIS

DOWN
1. OLFACTORY
2. FORAMEN
5. TRIGEMINAL
7. CORNEA
9. CONJUNCTIVA
10. SPINAL ACCESSORY
12. ABDUCENS
13. AUDITORY

Crossword Puzzle 7

ACROSS
1. THORACIC NERVES
4. RADIAL
7. LUMBAR NERVES
9. INTERCOSTAL
11. PHRENIC
12. FEMORAL
13. SCIATIC
14. PLEXUS

DOWN
2. CERVICAL NERVES
3. SACRAL NERVES
5. AXILLARY
6. ULNAR NERVE
8. MEDIAN NERVE
10. COCCYGEAL NERVES

Crossword Puzzle 8

ACROSS
1. MULTIPLE SCLEROSIS
6. DEGENERATIVE
7. ACOUSTIC NEUROMA
8. GLIOMA
11. EPENDYMOMA
12. HYDROCEPHALUS

DOWN
2. PROGRESSIVE
3. SCLEROSIS
4. NEUROFIBROMATOSIS
5. NEUROMA
9. ASTROCYTOMA
10. MENINGITIS

Crossword Puzzle 9

ACROSS

1. CEREBRAL PALSY
3. THROMBUS
5. EPILEPSY
6. ANEURYSM
8. HERPES ZOSTER
9. TRIGEMINAL NEURALGIA

DOWN

1. CEREBROVASCULAR ACCIDENT
2. ALZHEIMERS DISEASE
4. HUNTINGTONS DISEASE
7. PARKINSONS DISEASE

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 17

1. If a peripheral nerve is injured, what becomes of the part of the nerve fiber that is separated from the cell body?

   a. It disintegrates.

   b. It reattaches to the cell body.

   c. It forms a new neuron.

   d. It is absorbed into the lymphatic system and eliminated with urea.

Objective 13

2. Motor neurons are located in the _____ and _____.

   a. central; peripheral nervous systems

   b. white; gray matter

   c. sympathetic; parasympathetic nervous systems

   d. glands; muscles

Objective 24

3. The forebrain is also called the _____.

   a. *prosencephalon*

   b. *mesencephalon*

   c. *rhombencephalon*

   d. *cerebellum*

Objective 10

4. _____ is neural tissue that consists largely of myelinated nerve fiber and has a whitish color.

   a. White matter

   b. Myelin

   c. Neurilemma

   d. Neuroglia

Objectives 3 & 4

5. Which of the following is NOT part of the peripheral nervous system?

   a. cranial nerves

   b. spinal cord

   c. spinal nerves

   d. autonomic nervous system

Objective 18

6. _____ move so that they can locate and destroy damaged tissue and invading cells and organisms.

   a. Oligodendrocytes

   b. Astrocytes

   c. Ependyma

   d. Microglia

Objective 5

7. The part of the autonomic nervous system that prepares the body to deal with emergencies is the _____.

   a. somatic nervous system

   b. sympathetic nervous system

   c. parasympathetic nervous system

   d. peripheral nervous system

Objective 26

8. The _____ is the portion of the hindbrain that is continuous posteriorly with the spinal cord.

   a. cerebrum

   b. diencephalon

   c. cerebellum

   d. medulla oblongata

Objectives 7 & 8

9. Which of the following statements is NOT true of a neuron?

   a. A neuron is a basic nerve-tissue cell capable of transmitting nerve impulses.

   b. A neuron plays a role when there is injury or infection in the nervous system.

   c. An axon is one of the major structures of a neuron that carries impulses from the cell body of the neuron.

   d. A dendrite is one of the major structures of a neuron that carries impulses to the cell body of the neuron.

Objective 9

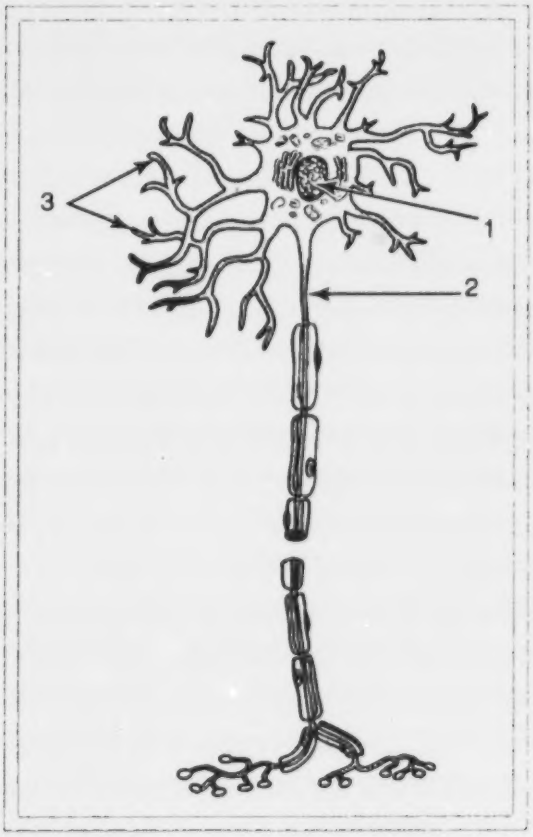
10. In the illustration below, which of the following shows the correct labeling for the structures of a neuron?

    a. (1) dendrite, (2) cell body, (3) axon

    b. (1) cell body, (2) axon, (3) dendrites

    c. (1) axon, (2) dendrite, (3) cell body

    d. (1) axon, (2) cell body, (3) dendrites



Objective 3

11. The _____ is the part of the nervous system that consists of the brain and spinal cord.

    a. CNS

    b. PNS

    c. SNS

    d. ANS

Objective 10

12. A nerve fiber is an elongated process of a neuron—usually the _____.

    a. neuroglia
    b. cell body
    c. axon
    d. dendrite

Objective 40

13. _____ means "becoming more involved."

    a. Sclerosis
    b. Progressive
    c. Degenerative
    d. Benign

Objective 28

14. A _____ is a portion of any organ that is demarcated by sulci, fissures, or connective tissue.

    a. hemisphere
    b. lobe
    c. ventricle
    d. rhombencephalon

Objective 11

15. The layer of cells composed of one or more Schwann cells that enclose the myelin sheath of a nerve fiber is the _____.

    a. axis cylinder
    b. axon
    c. neurilemma
    d. neuroglia

Objective 15

16. A reflex arc consists of _____ that provides a signal through a sensory neuron into a spinal nerve and into the spinal cord.

    a. an effector
    b. an affector
    c. an impulse
    d. a synapse

Objective 12

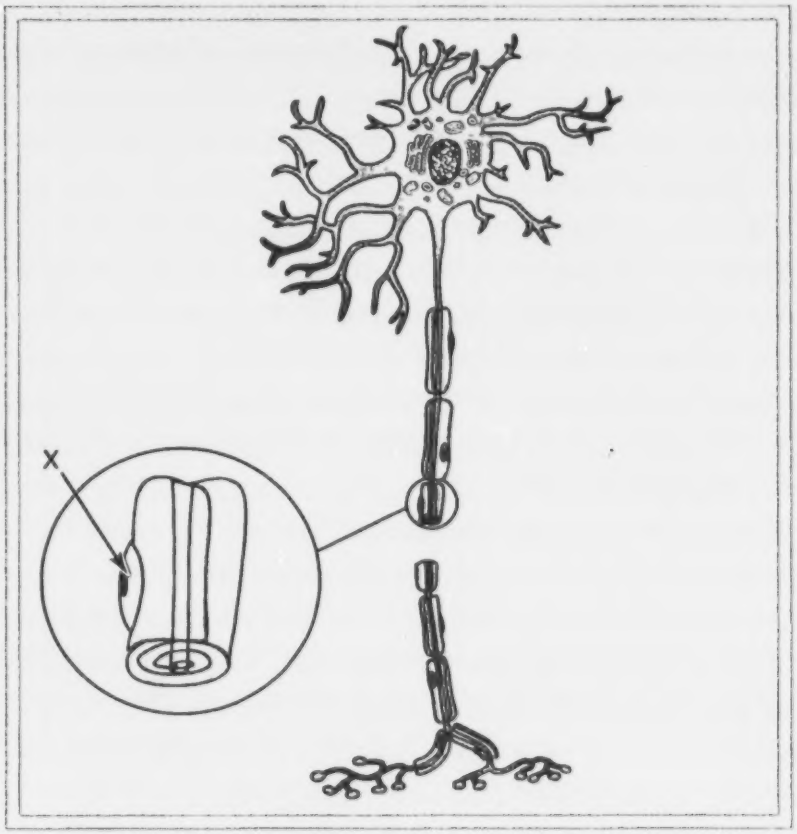
17. The major structure of a nerve fiber that is indicated by the letter "X" in the illustration below is the _____.

    a. axon

    b. axis cylinder

    c. myelin sheath

    d. nucleus of Schwann cell



Objective 2

18. Which of the following is NOT a function of the nervous system?

    a. receives internal and external stimuli through the sensory organs

    b. generates external stimuli

    c. stores any needed information

    d. coordinates any required responses

Objective 28

19. A _____ is a shallow groove on the surface of an organ.

a. sulcus

b. fissure

c. lobe

d. ventricle

Objective 13

20. Sensory neurons are also called _____ *neurons.*

a. *afferent*

b. *efferent*

c. *central*

d. *internuncial*

Objective 26

21. Which of the following is NOT a correct statement about the structures of the forebrain and hindbrain and their functions?

a. The diencephalon includes the pons, which serves as a relay center and functions in the integration of sensory information.

b. The pons relays impulses between the cerebrum and cerebellum and the cerebrum and the medulla oblongata.

c. The medulla oblongata controls vital functions such as breathing, heart rate, blood pressure, swallowing, and coughing.

d. The cerebellum maintains body balance, equilibrium, coordination, and muscle tone.

Objective 13

22. Which of the following statements is NOT true concerning interneurons?

a. Interneurons are also called *central neurons.*

b. Interneurons are found only in the central nervous system.

c. Interneurons transmit messages from the central nervous system to all parts of the body.

d. Interneurons conduct messages or impulses from sensory to motor neurons.

Objective 38

23. Which of the following is NOT a correct match between names and numbers of spinal nerve pairs?

a. cervical, 8

b. thoracic, 10

c. lumbar and sacral, 5 each

d. coccygeal, 1

Objective 14

24. Two or more _____ arranged in a chain function to conduct impulses from one place to another.

a. axons

b. neurons

c. dendrites

d. hemispheres

Objective 39

25. The _____ nerve is a major nerve of the lumbar plexus.

a. femoral

b. sciatic

c. humerus

d. coccygeal

Objective 16

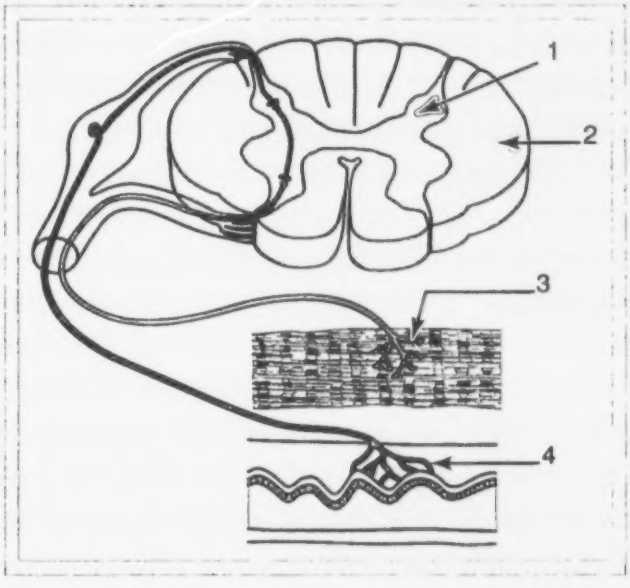
26. In the illustration below, which of the following shows the correct labeling for the structures of a reflex arc.

a. (1) white matter, (2) gray matter, (3) affector, (4) effector

b. (1) gray matter, (2) white matter, (3) affector, (4) effector

c. (1) gray matter, (2) white matter, (3) effector, (4) affector

d. (1) white matter, (2) gray matter, (3) effector, (4) affector



Objective 1

27. The extensive intricate network of structures that activates, coordinates, and controls all the functions of the body is the _____.

    a. . sensory organs

    b. central nervous system

    c. peripheral nervous system

    d. nervous system

Objective 17

28. In Stage 3 of the regeneration of a peripheral nerve, the _____ stump that is attached to the cell body grows into the repaired _____ tube.

    a. axon; neurilemmar

    b. axon; dendritic

    c. dendritic; neurilemmar

    d. neurilemmar; axon

Objective 18

29. _____ are neuroglia that prevent harmful chemicals from entering the brain from contaminated food.

    a. Oligodendrocytes

    b. Astrocytes

    c. Ependyma

    d. Microglia

Objective 4

30. The part of the peripheral nervous system that connects the central nervous system to the skin and skeletal muscles is the _____.

    a. autonomic nervous system

    b. sympathetic nervous system

    c. somatic nervous system

    d. parasympathetic nervous system

Objective 19

31. Which of the following is NOT a major structure within the spinal canal?

    a. spinal cord

    b. cerebrospinal fluid

    c. meninges

    d. lymphatic vessels

Objective 35

32. The _____ cranial nerve pair control four muscles of the eye.

a. oculomotor

b. trochlear

c. abducens

d. facial

Objective 26

33. The _____ is also called the *telencephalon.*

a. cerebrum

b. diencephalon

c. cerebellum

d. medulla oblongata

Objective 38

34. The term _____ means "pertaining to the space between two ribs."

a. *phrenic*

b. *axillary*

c. *femoral*

d. *intercostal*

Objective 20

35. The spinal cord acts as a conduction pathway for impulses between the _____ nerves to and from the brain.

a. peripheral

b. sensory

c. motor

d. connecting

Objective 29

36. Which of the following is NOT a correct statement about the lobes of the brain and their functions?

a. The frontal lobe controls voluntary muscles and judgment.

b. The parietal lobe controls sensory functions such as pain, touch, and temperature interpretation.

c. The temporal lobe controls hearing, smell, and taste.

d. The occipital lobe controls involuntary functions.

Objective 20

37. Spinal nerves emerge from the spinal cord as two short roots, the _____ one for the sensory nerves and the _____ one for the motor nerves.

a. medial; lateral

b. lateral; medial

c. dorsal; ventral

d. ventral; dorsal

Objective 39

38. The term *sciatic* pertains to _____.

a. the hipbone

b. the bone of the forearm

c. the radial portions of the hand

d. the cavity beneath the junction of the forelimb and the body

Objective 21

39. What is the function of cerebrospinal fluid?

a. circulates around the brain and spinal cord, providing nutrients and carrying away wastes

b. circulates around the brain and spinal cord, providing a barrier between the neurons and direct contact with blood

c. circulates around the brain and spinal cord, maintaining a constant temperature in the central nervous system

d. circulates around the brain and spinal cord, maintaining an even pressure and acting as a cushion or shock absorber

Objective 22

40. Which of the following is NOT a component of cerebrospinal fluid?

a. water

b. glucose

c. sodium fluoride

d. some waste products, such as urea

Objective 33

41. There are _____ cavities called *ventricles* in the brain.

a. 2

b. 4

c. 6

d. 8

Objective 23

42. The layer of the meninges that contains blood vessels is the _____.

a. arachnoid

b. dura mater

c. pia mater

d. medius mater

Objective 39

43. Which of the following is NOT a nerve of the brachial plexus?

a. axillary

b. median

c. radial

d. T-2

Objective 24

44. Which of the following is also called the *rhombencephalon*?

a. forebrain

b. midbrain

c. hindbrain

d. frontal lobe

Objective 2

45. The nervous system transmits messages to and from the _____.

a. sensory organs

b. motor organs

c. spinal cord

d. brain

Objective 26

46. The _____ is the posterior subdivision of the forebrain that includes the thalamus.

a. cerebrum

b. diencephalon

c. cerebellum

d. medulla oblongata

Objective 25

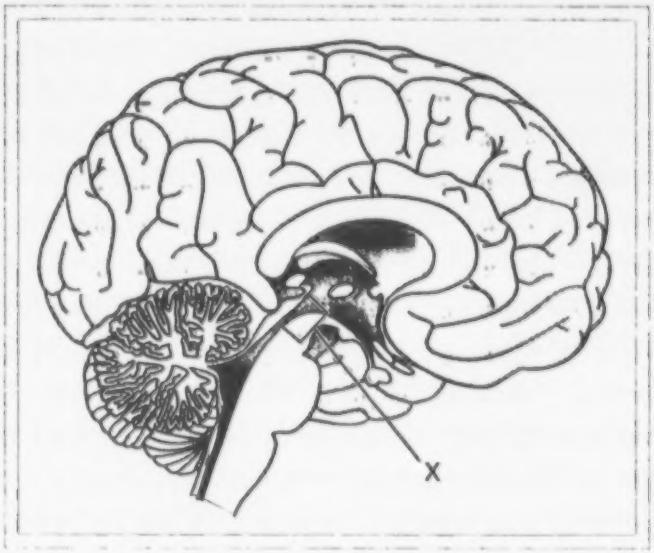
47. The primary division of the brain indicated by the letter "X" in the illustration below is the _____.

    a. forebrain

    b. secondary brain

    c. midbrain

    d. hindbrain



Objective 6

48. Tissue consisting of one or more bundles of impulse-carrying fibers that connect the brain and the spinal cord with other parts of the body is _____.

    a. white matter

    b. myelin

    c. sulcus

    d. nerve tissue

Objective 13

49. Sensory neurons are controlled by the _____.

    a. frontal lobe of the brain

    b. pons

    c. thalamus

    d. meninges

Objective 20

50. The spinal cord is a small cord about _____ inches long in an adult.

    a. 10

    b. 12

    c. 18

    d. 24

Objective 27

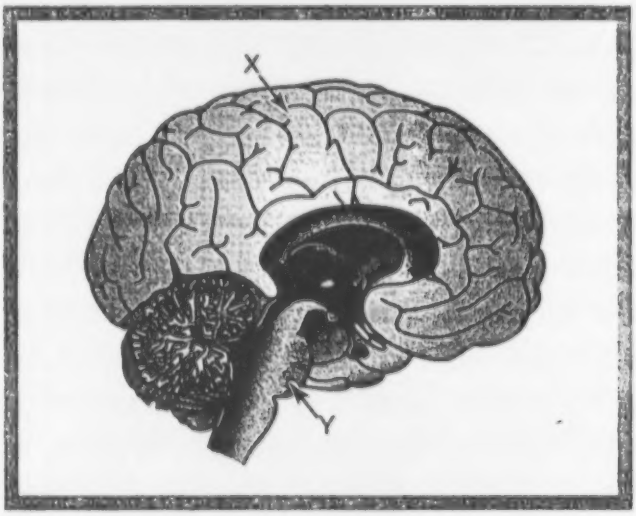
51. The structure of the forebrain indicated by the letter "X" in the illustration below is the _____.

    a. cerebrum

    b. diencephalon

    c. cerebellum

    d. pons



Objective 27

52. The structure of the hindbrain indicated by the letter "Y" in the illustration above is the _____.

    a. cerebrum

    b. diencephalon

    c. cerebellum

    d. pons

Objective 27

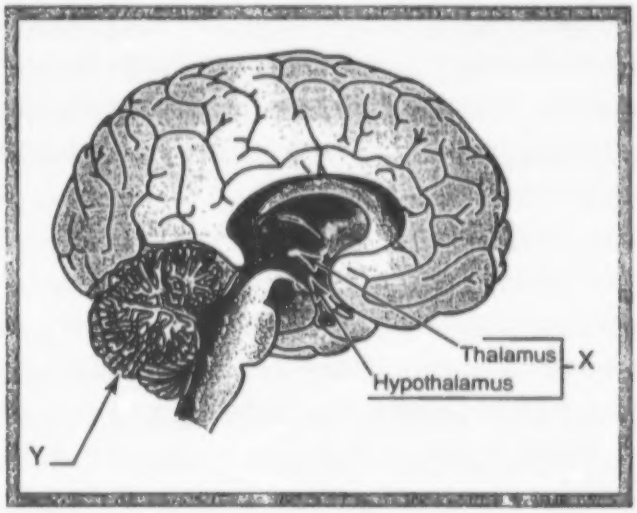
53. The structure of the forebrain that is indicated by the letter "X" in the illustration below is the _____.

a. cerebrum

b. diencephalon

c. cerebellum

d. pons



Objective 27

54. The structure of the hindbrain that is indicated by the letter "Y" in the illustration above is the _____.

a. cerebrum

b. diencephalon

c. cerebellum

d. pons

Objective 13

55. Motor neurons are controlled by the _____ lobe of the brain.

a. frontal

b. occipital

c. temporal

d. parietal

Objective 11

56. The _____ is a fatty, segmented covering of a nerve fiber that wraps the axon and acts as an electrical insulator.

a. axis cylinder

b. myelin sheath

c. neurilemma

d. neuroglia

Objective 20

57. In cross-section, the spinal cord exhibits an H-shaped area of _____ matter surrounded by an outer region of _____ matter.

a. gray; white

b. white; gray

c. neurilemma; myelin

d. myelin; neurilemma

Objective 29

58. The _____ lobe is the middle division of each cerebral hemisphere.

a. frontal

b. parietal

c. occipital

d. temporal

Objective 29

59. The _____ lobe is the posterior lobe of each cerebral hemisphere.

a. frontal

b. parietal

c. occipital

d. temporal

Objective 30

60. The _____ fissure divides the cerebrum into two hemispheres.

a. longitudinal

b. lateral

c. central

d. medial

Objective 31

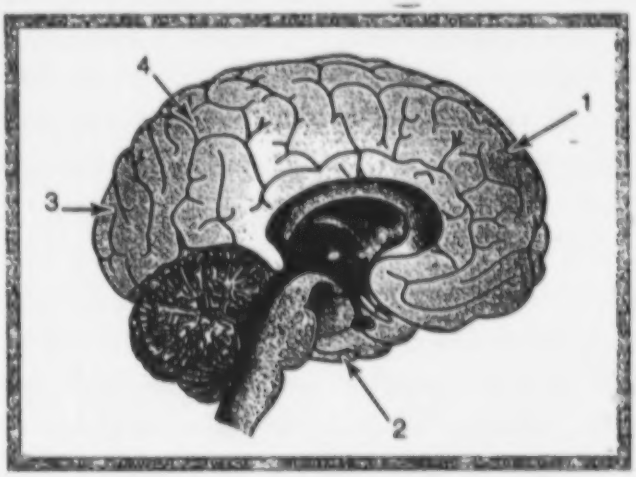
61. In the illustration below, which of the following shows the correct labeling for the lobes of the cerebrum?

a. (1) frontal lobe, (2) temporal lobe, (3) parietal lobe, (4) occipital lobe

b. (1) frontal lobe, (2) temporal lobe, (3) occipital lobe, (4) parietal lobe

c. (1) temporal lobe, (2) frontal lobe, (3) occipital lobe, (4) parietal lobe

d. (1) temporal lobe, (2) frontal lobe, (3) parietal lobe, (4) occipital lobe



Objective 30

62. The _____ fissure divides the temporal lobe from the parietal lobe.

a. longitudinal

b. lateral

c. central

d. medial

Objective 23

63. The hard, outermost layer of the meninges is the _____.

a. arachnoid

b. dura mater

c. pia mater

d. medius mater

Objective 32

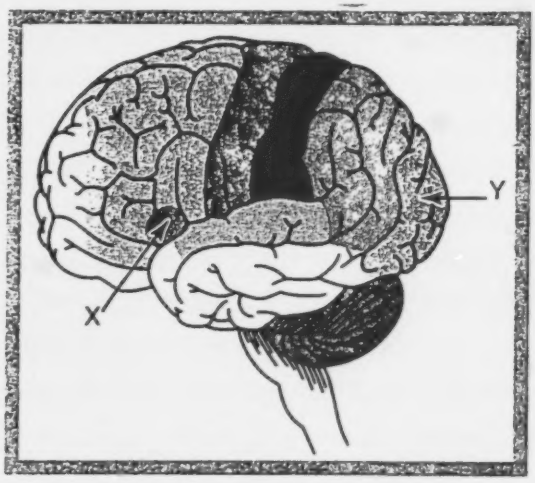
64. The _____ functional area of the brain is indicated by the letter "X" in the illustration below.

a. premotor

b. visual

c. motor-speech

d. general sensory



Objective 32

65. The _____ functional area of the brain is indicated by the letter "Y" in the illustration above.

a. premotor

b. visual

c. motor-speech

d. general sensory

Objective 40

66. A tumor that arises in the lining of the ventricles is called _____.

a. a *neuroma*

b. a *glioma*

c. an *astrocytoma*

d. an *ependymoma*

Objective 33

67. The lateral ventricles are located inside the _____.

a. cerebellum

b. cerebral hemispheres

c. pons

d. frontal lobe

Objective 23

68. The term that means "tender mother" in Latin is _____.

a. dura mater

b. pia mater

c. arachnoid mater

d. sulcus

Objective 35

69. Which of the following is NOT a correct match of cranial nerve pair, number, and function?

a. olfactory: nerve pair I, sense of smell

b. optic: nerve pair II, sense of sight

c. oculomotor: nerve pair III, eye muscles

d. trochlear: nerve pair IV, sense of hearing

Objective 40

70. Meningitis results from _____.

a. an inflammation

b. an inherited disease

c. a tumor

d. a lesion

Objective 33

71. The _____ ventricle lies between the cerebellum and the pons and the medulla.

a. first

b. second

c. third

d. fourth

Objective 40

72. _____ is an inherited disease that produces numerous benign tumors in the Schwann cells of the nerve cells of the skin.

a. multiple sclerosis

b. multiple neurofibromatosis

c. hydrocephalus

d. cerebral palsy

Objective 35

73. The _____ cranial nerve pair control the tongue muscles.

a. trigeminal

b. glossopharyngeal

c. hypoglossal

d. vagus

Objective 33

74. Each lateral ventricle communicates with the third ventricle by way of the _____.

a. cerebral aqueduct of Sylvius

b. foramen of magendie

c. interventricular foramen

d. foramina of Luschka

Objective 40

75. A _____ is a blood clot that obstructs a blood vessel.

a. neuroma

b. glioma

c. aneurysm

d. thrombus

Objective 36

76. A _____ is a network of nerves from several segments of the spinal cord that combine to form nerves to specific parts of the body.

a. plexus

b. sulcus

c. fissure

d. ventricle

Objective 34

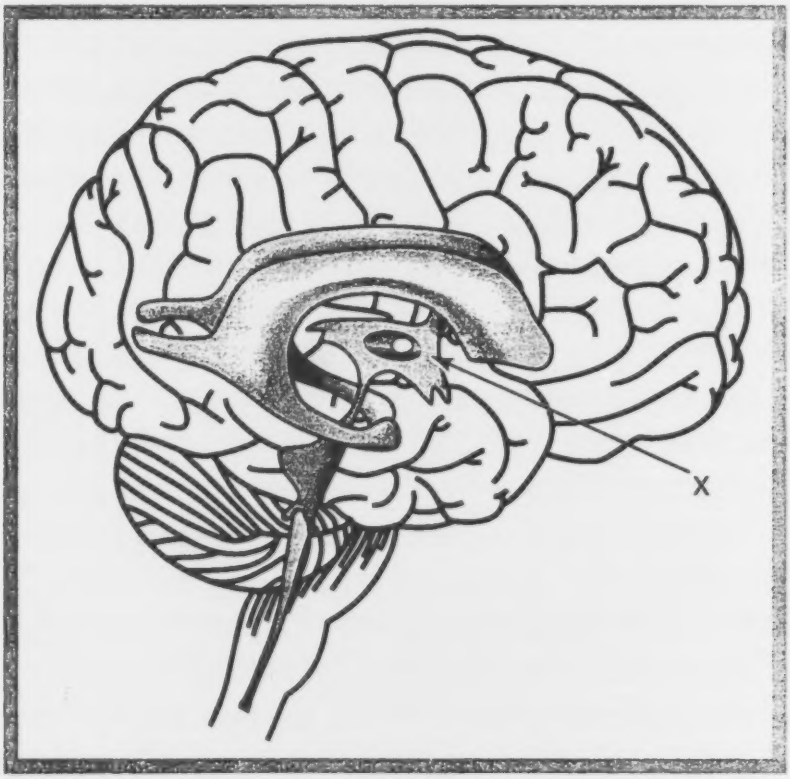
77. The structure indicated by the letter "X" in the illustration below is _____ of the brain.

a. one of the lateral ventricles

b. the third ventricle

c. the fourth ventricle

d. the inferior horn



Objective 35

78. Which of the following is the name and number of the cranial nerve pair that controls swallowing, hunger, speech, breathing, heart rate, peristalsis, and glands in the stomach and pancreas?

a. trigeminal, nerve pair V

b. abducens, nerve pair VI

c. vagus, nerve pair X

d. hypoglossal, nerve pair XII

Objective 37

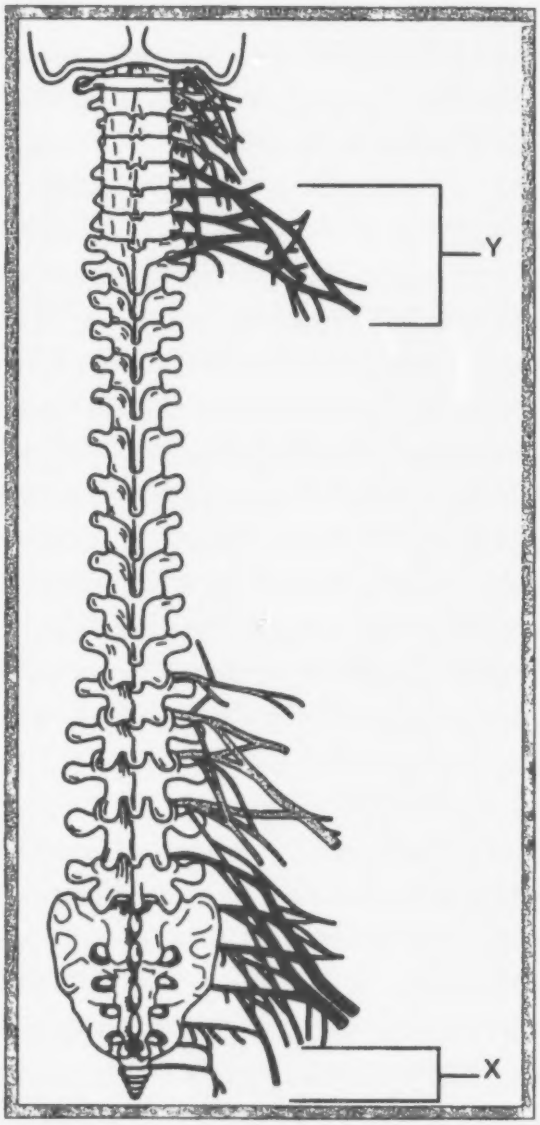
79. Which plexus of the spinal cord is indicated by the letter "X" in the illustration below?

a. cervical

b. thoracic

c. lumbar

d. coccygeal



Objective 37

80. Which plexus is indicated by the letter "Y" in the illustration above?

a. cervical

b. thoracic

c. brachial

d. sacral

Objective 14

81. When a neuron receives a signal, it sends an impulse on to the next neuron across the _____ between an axon and a dendrite.

a. cell body

b. ganglion

c. synapse

d. plexus

Objective 20

82. The spinal cord lies within the spinal canal surrounded by the _____.

a. medulla oblongata

b. myelin sheath

c. neurilemma tube

d. vertebrae

Objective 39

83. The cervical plexus includes nerves _____ and the _____ nerve.

a. C-1 through C-4; ulnar

b. C-1 through C-4; phrenic

c. C-5 through C-8; ulnar

d. C-5 through C-8; phrenic

Objective 23

84. What fills the subarachnoid space?

a. water

b. cerebrospinal fluid

c. air

d. blood

Objective 14

85. When a nerve impulse is blocked, the blocking usually takes place at a _____.

a. cell body

b. ganglion

c. synapse

d. plexus

Objective 40

86. _____ is a progressive nerve disorder that leads to degeneration of the myelin sheaths of CNS nerve cells.

a. multiple sclerosis

b. multiple neurofibromatosis

c. hydrocephalus

d. cerebral palsy

Objective 33

87. The ventricles are filled with _____.

a. cerebrospinal fluid

b. air

c. water

d. synovial fluid

Objective 15

88. _____ is nerve tissue that consists of motor neurons and interneurons.

a. White matter

b. Gray matter

c. Myelin

d. Neurilemma

Objective 40

89. _____ is a degenerative condition in neurons that leads to overstimulation of skeletal muscles.

a. Alzheimer's disease

b. Huntington's disease

c. Parkinson's disease

d. Herpes zoster

Objective 33

90. Inside each ventricle are tiny masses of specialized capillaries called _____, which secrete _____.

a. *choroid plexuses*; cerebral mucus

b. *choroid plexuses*; cerebrospinal fluid

c. *ventricular nodes*; cerebral mucus

d. *ventricular nodes*; cerebrospinal fluid

Objective 11

91. The central core of jelly-like material in a nerve fiber is called the _____.

a. *axis cylinder*

b. *myelin sheath*

c. *neurilemma*

d. *neuroglia*

Objective 35

92. The _____ cranial nerve pair support the sense of taste and control swallowing.

a. facial

b. auditory

c. glossopharyngeal

d. spinal accessory

Objective 20

93. The spinal cord extends from the medulla of the brain to the first lumbar vertebra or top of the second lumbar vertebra, where it begins to taper into a horsetail of fibers that finally ends in the _____ area.

a. coccygeal

b. thoracic

c. lower lumbar

d. sacral

Objective 33

94. An opening in a membranous structure is a _____.

a. ventricle

b. foramen

c. aqueduct

d. plexus

Objective 33

95. Each lateral ventricle possesses a posterior, anterior, and inferior _____.

a. horn

b. process

c. head

d. nerve fiber

Objective 40

96. A cerebrovascular accident is _____.

a. a lesion in the brain

b. an inflammation of the meninges usually caused by a bacterial infection

c. a condition of recurring pain as a result of disease or injury in the C5 nerve

d. a condition of recurring or chronic seizures

Objective 3

97. The row of aligned holes in the vertebrae through which the spinal cord passes is the _____.

a. CNS

b. PNS

c. spinal cord

d. spinal canal

Objective 4

98. The term *somatic* means _____.

a. preparing the body to deal with emergencies

b. occurring involuntarily

c. affecting the body

d. restoring homeostatic balance

Objective 40

99. A type of tumor that develops from the eighth cranial nerve is _____.

a. a glioma

b. an astrocytoma

c. an ependymoma

d. an acoutic neuroma

Objective 33

100. The third ventricle is located in the _____ with the thalamus and hypothalamus.

a. diencephalon

b. cerebellum

c. pons

d. medulla oblongata

Answers to Module Review

1. a	21. a	41. b	61. b	81. c
2. d	22. c	42. c	62. b	82. d
3. a	23. b	43. d	63. b	83. b
4. a	24. b	44. c	64. c	84. b
5. b	25. a	45. d	65. b	85. c
6. d	26. c	46. b	66. d	86. a
7. b	27. d	47. c	67. b	87. a
8. d	28. a	48. d	68. b	88. b
9. b	29. b	49. c	69. d	89. c
10. b	30. c	50. c	70. a	90. b
11. a	31. d	51. a	71. d	91. a
12. c	32. a	52. d	72. b	92. c
13. b	33. a	53. b	73. c	93. a
14. b	34. d	54. c	74. c	94. b
15. c	35. a	55. a	75. d	95. a
16. b	36. d	56. b	76. a	96. a
17. d	37. c	57. a	77. b	97. d
18. b	38. a	58. b	78. c	98. c
19. a	39. d	59. c	79. d	99. d
20. a	40. c	60. a	80. c	100. a

MODULE SET II:
Major Body Systems

Module 5: Endocrine System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Endocrine System	9
2—Major Endocrine Glands	11
Written Test	13
Answers to Written Test	25
Answers to Assignment Sheet	29
Crossword Puzzles	
1—Terms from Objectives 1 Through 3	31
2—Terms from Objective 6	33
3—Terms from Objectives 7 Through 11	35
4—Terms from Objective 13	37
5—Terms from Objectives 14 Through 20	39
6—Terms from Objective 21	41
Answers to Crossword Puzzles	43
Module Review	45
Answers to Module Review	57

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module serves as something of a transition between the systems that perform generalized functions for the whole body to the systems that are more specialized and that have more-distinct organ structures. The skin, skeleton, and muscles provide the overall structure of the body and generally perform their functions throughout the body. Beginning with this module, the students will encounter more and more specialized structures that are related but which perform clearly distinct functions. For example, in this module, the students will study endocrine organs, and in the next module, they will learn about the organs of special senses. It is important that the students recognize this transition. The systems presented in the remaining modules—while consisting of structures with a common overall function—generally involve numerous differences in tissue composition and specific functioning.

- Use crossword puzzles 1 through 6 to help reinforce the terms in the associated objectives.
- By this point, the students should be able to visualize the human body as a large container of chemicals that must interact with each other in specific ways to sustain life. Perform a simple chemical demonstration. For example, add one chemical to another so as to cause a precipitate to appear or to cause a color change. Help the students to recall what they studied about chemical reactions in Module Set I: how chemicals can combine to produce other chemicals and energy and how catalysts are sometimes required to initiate or accelerate such reactions. Present the first two objectives, explaining that endocrine glands release chemicals called *hormones* that are designed to cause reactions in other cells.
- Provide examples of the kinds of processes that can be affected by the chemicals released by endocrine glands. Choose one or more of these processes and discuss them in enough detail to help the students understand the concept. For example, "growth and development" are functions the students can relate to fairly easily. Discuss the changes that take place in human development as a result of growth hormones and sex hormones. Use illustrations of human growth and development to aid the discussion. Provide photographs of persons with related hormone disorders such as those exhibiting giantism, dwarfism, or abnormal secondary sexual characteristics.
- Introduce the remaining objectives by discussing the locations of the endocrine glands in the body. Use the artwork in Objective 4 to illustrate your discussion.
- To supplement Objective 5 and Objective 6, indicate the location of the pituitary gland and discuss its structure, hormones, and functions. During your discussion and with subsequent objectives dealing with the functions of other glands, relate the functions to the types of actions previously discussed. For example, somatotrophic hormone regulates growth and thyrotropic hormone regulates functional activity of the thyroid gland.

- Objective 7 is a good opportunity to introduce the concepts of inadequate and excessive secretions of hormones. Discuss ways of compensating for these abnormalities.

- To supplement Objective 8, discuss the thyroid, pointing out that it secretes thyroxine. Explain that thyroxine is actually two different compounds, one with three iodine atoms and one with four. The four-atom molecule is often converted to the three-iodine version because the three-iodine hormone is more usable by cells. Recently, researchers have discovered that the thyroid also produces calcitonin, a hormone that appears to regulate the calcium content of the blood, acting in conjunction with the parathyroid hormone to control the release of calcium from the bones.

- Discuss disorders associated with the thyroid, which are presented in Objective 9. Display illustrations of goiters. Discuss the need for iodine and sources for iodine, including iodized salt.

- Use models and illustrations to supplement your discussion in Objective 10, which describes the structure and function of the parathyroid. Have students locate the parathyroid gland on an illustration of the human body. Review the role of calcium and potassium in the functioning of the neuromuscular system to indicate the importance of proper calcium balance. Describe the functioning of the parathyroid gland in the role of muscle functioning. Use this discussion to lead into a review of disorders of the parathyroid, which are presented in Objective 11.

- Use models and illustrations to discuss the structure and function of the adrenal glands, which are presented in Objective 12. Continue the discussion of the functioning of the adrenal glands to include the role of each hormone, as presented in Objective 13. Introduce other anatomical features that are related to the functioning of the adrenals, such as female reproductive organs. Conclude the discussion by covering abnormalities and disorders, as presented in Objective 14. Invite patients afflicted with Parkinson's disease or Cushing's syndrome or physicians specializing in those conditions to discuss the diseases and their treatment.

- To supplement Objective 15 and Objective 16, discuss gonads, testes, and ovaries at an introductory level. Use models and illustrations to discuss the structure and functioning of the gonads. Describe the effects of secretion problems in the gonads.

- Discuss the pancreas and the functioning of its hormones, as presented in Objective 17. Invite persons with diabetes and hypoglycemia to discuss their conditions, as presented in Objective 18. Discuss advances in insulin dispensing and treatment.

- Discuss the pineal body, as presented in Objective 19, then introduce articles and other documents related to seasonal affective disorder and research on melatonin.

- Use illustrations and models to discuss the structure and functioning of the thymus, which is presented in Objective 20. Review the immune system to the extent necessary to help the students see the role of the thymus through embryonic development and postnatal growth.

- To supplement Objective 21, locate other structures with endocrine functions. Discuss the role of these structures in human health.

Resources used in developing this module

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.

- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites offer information about the endocrine glands and related body functions. Web sites listed in other modules may also be useful in providing instruction with this module.

- http://library.thinkquest.org/10348/find/content/endocrine.html

  This site provides short descriptions of the endocrine glands with an emphasis on the differences between male and female structures and functions.

- http://www.pslgroup.com/dg/endocrinenews.htm

  News articles about the endocrine system are provided on this web site.

- http://www.mcl.tulane.edu/classware/pathology/medical_pathology/endocrine_cases/casesTop.html

  This site offers advanced case studies related to the endocrine system. Some of the case studies are fairly advanced. However, they provide useful information and can benefit students, especially students who are progressing well.

- http://www.geocites.com/HotSprings/2255/endocrine.html

  The case studies provided in this site are somewhat less complex than those on the site listed above. The site also contains links for diabetes.

- http://www-medlib.med.utah.edu/WebPath/ENDOHTML/ENDOIDX.html

  This site features images of endocrine glands.

- http://www.niddk.nih.gov/

  The National Institute of Health hosts this site dedicated to topics related to diabetes, digestion, and the kidneys.

- http://www.drscope.com/sitios/endocrinology.html

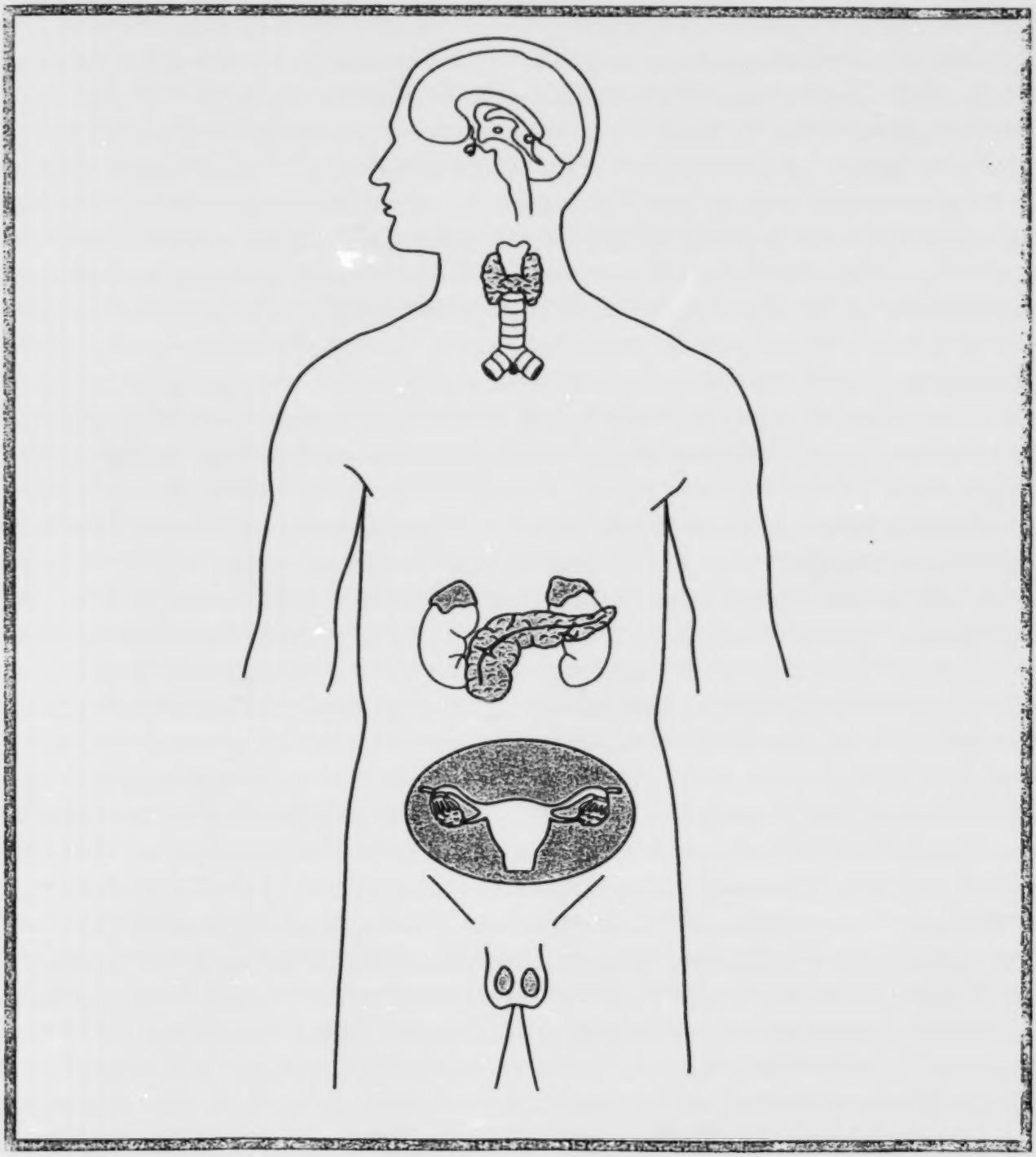
  This site offers numerous links, including some of those previously referenced.

- http://gened.emc.maricopa.edu/bio/bio181/BIOBK/BioBookENDOCR.html

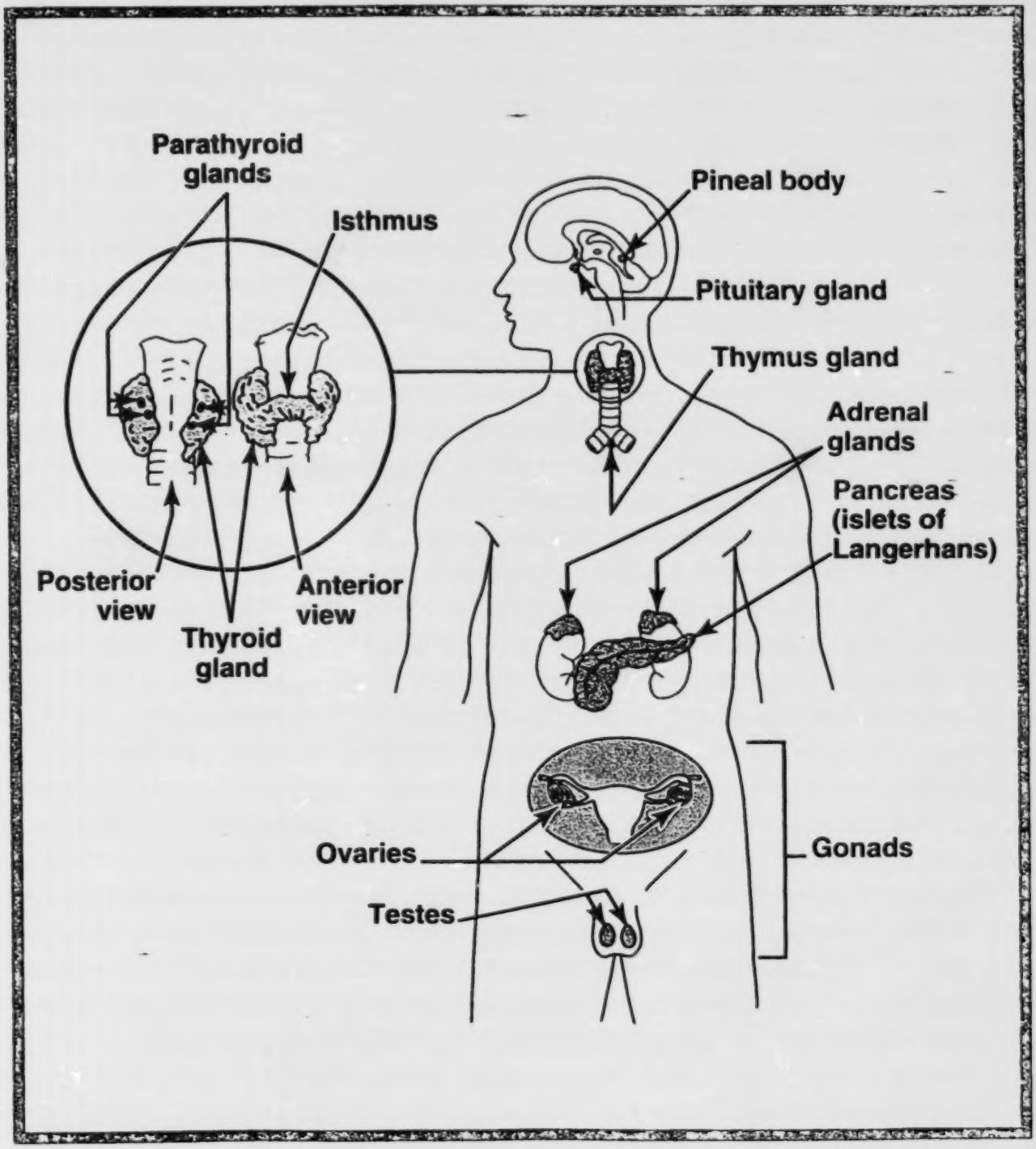
  This is one of the better sites dealing with the endocrine system. It offers good graphics and detailed information.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

Endocrine System



Major Endocrine Glands



Written Test

Name _____

Date _____ Score _____

OBJECTIVE 1 Define the term *endocrine system*. Write your answer on the blank lines provided beside the term below.

Endocrine system _____

_____

_____

OBJECTIVE 2 List the primary physiological characteristics of the body that are affected by the hormones of the endocrine system. Write your answers on the blank lines provided below.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

e. _____

_____

f. _____

_____

g. _____

_____

h. _____

_____

i. _____

_____

OBJECTIVE 3

Match the major glands of the endocrine system to their correct definitions. Write the numbers on the blanks provided.

_____ a. A glandular structure of largely lymphoid tissue typically located in the upper anterior chest or at the base of the neck

_____ b. The fish-shaped, grayish-pink nodular gland that lies inferior to the stomach, functions both as an exocrine and endocrine gland, and contains special cells called the *islets of Langerhans*, which are scattered throughout the gland and produce endocrine secretions

_____ c. The small, conical endocrine gland that lies near the middle of the brain

_____ d. The endocrine glands that are located superior to the kidneys, each fitting like a cap on the top of each kidney

_____ e. The endocrine gland that is located at the base of the brain in a small depression of the sphenoid bone of the cerebrum, known as the *sella turcica*; the gland that is sometimes referred to as the *master gland* or *moderator gland* because it affects other glands in the endocrine system

_____ f. The four, small, bean-shaped bodies that lie on the posterior surface of the lobes of the thyroid gland

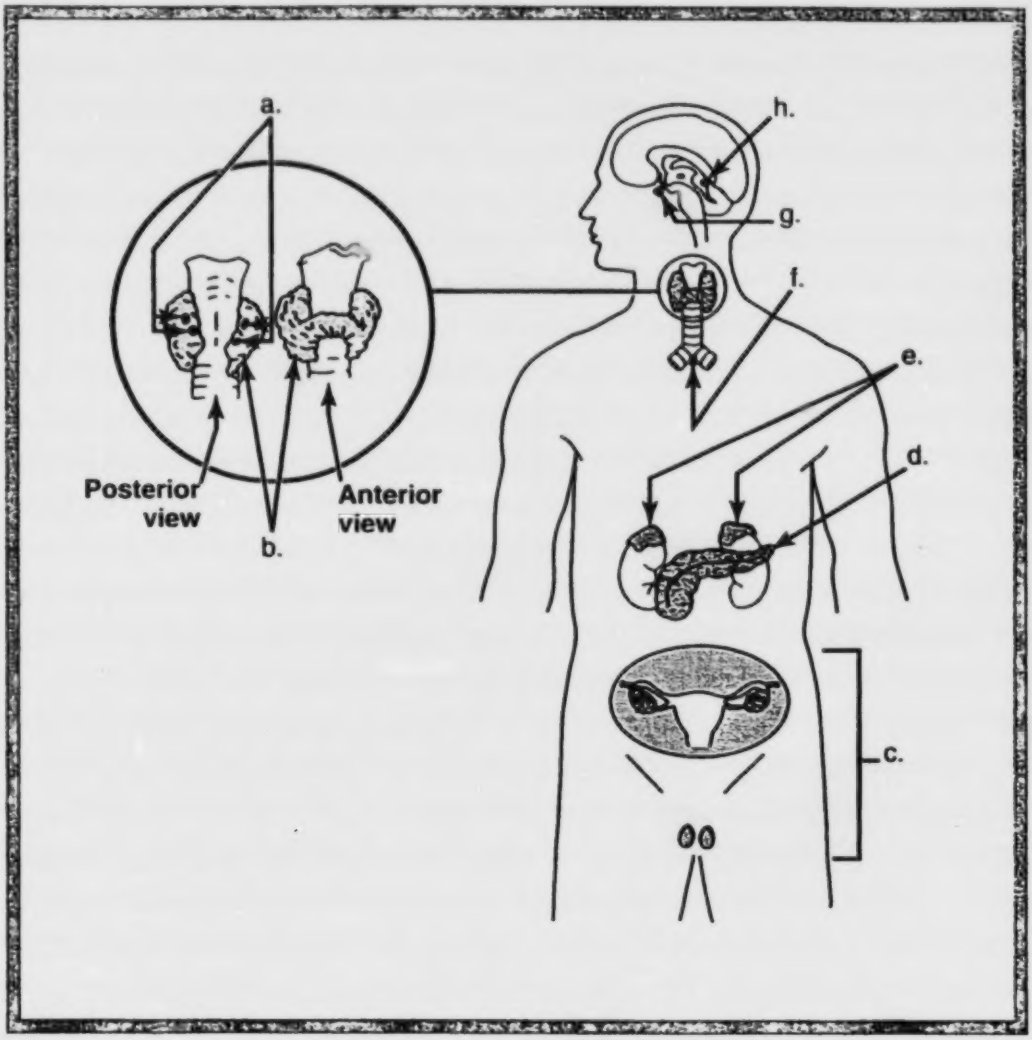
_____ g. A glandular structure consisting of one lobe on either side of the trachea and connected in the midline by the isthmus; the largest of all the endocrine glands

_____ h. The generic term for the sex glands of both sexes that produce the cells of reproduction; the ovaries in the female and the testes in the male

1. Adrenal glands
2. Gonads
3. Pancreas
4. Parathyroid glands
5. Pineal body
6. Pituitary gland
7. Thymus gland
8. Thyroid gland

OBJECTIVE 4

Label the major glands of the endocrine system. Write your answers on the blank lines provided below the following illustration.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____ h. _____

Objective 5

Complete statements that describe the structure and function of the pituitary gland. Write your answers on the blank lines provided in the statements below.

a. The pituitary gland is divided into two lobes—the _____ lobe and the _____ lobe.

b. The _____ lobe of the pituitary gland is connected to the hypothalamus.

c. Two hormones are produced by the hypothalamus and then are secreted by the _____ lobe of the pituitary gland.

d. Six hormones are secreted from the _____ lobe of the pituitary gland.

e. One hormone is secreted in the portion of the pituitary gland between the _____ and _____ lobes.

Objective 6

Match the primary hormones of the pituitary gland to their correct functions. Write the numbers on the blanks provided.

_____ a. Regulates growth

_____ b. Regulates the functional activity of the thyroid gland

_____ c. Maintains the mature corpora lutea, induces the secretion of progesterone, and induces the secretion of milk in a fully developed mammary gland

_____ d. Influences melanin formation

_____ e. Regulates the functional activity of the adrenal cortex

_____ f. Induces the secretion of estrogens, ovulation, and the development of the corpus luteum

_____ g. Induces the contraction of the smooth muscles of the blood vessels to regulate blood pressure; is associated with an antidiuretic principle that prevents excessive loss of water through the kidneys; causes reabsorption of water in the nephron tubes

_____ h. Stimulates the uterus to contract and acts on the mammary glands to stimulate the release of milk

_____ i. Stimulates the development of the ovarian follicles and spermatogenesis in the testes

1. Adrenocorticotropic hormone
2. Follicle-stimulating hormone
3. Luteinizing hormone
4. Luteotropic hormone
5. Melanocyte-stimulating hormone
6. Oxytocin
7. Somatotrophic hormone
8. Thyrotropic hormone
9. Vasopressin

Objective 7

Define common disorders and abnormalities associated with the hormones of the pituitary gland. Write your answers on the blank lines provided beside each of the terms below.

a. Diabetes insipidus _____

_____

_____

b. Dwarfism _____

_____

_____

c. Giantism _____

_____

_____

d. Acromegaly _____

_____

_____

Objective 8

Complete statements that describe the function of the thyroid gland. Write your answers on the blank lines provided in the statements below.

a. The thyroid gland secretes the hormone _____.

b. The thyroid gland requires the intake of iodine in order to synthesize _____.

c. _____ is transported in the blood by binding itself to proteins.

d. Thyroid function can be indicated by the measurement of _____ iodine in the plasma.

e. Thyroid hormones aid in regulating metabolism, especially the metabolism of _____ and _____.

f. Thyroid hormones affect the secretion and function of _____.

g. Thyroid hormones are required for normal development of the _____ system.

Objective 9 Define common disorders and abnormalities associated with the hormones of the thyroid gland. Write your answers on the blank lines provided beside each of the terms below.

a. Goiter _____

_____

_____

b. Grave's disease _____

_____

_____

c. Myxedema _____

_____

_____

d. Cretinism _____

_____

_____

Objective 10 Complete statements that describe the function of the parathyroid glands. Write your answers on the blank lines provided in the statements below.

a. The parathyroid glands secrete _____.

b. _____ acts to maintain a constant concentration of calcium in the extracellular fluid; the hormone regulates the absorption of calcium from the _____ tract, mobilization of calcium from the _____, deposition of calcium in the _____, and excretion of calcium in the _____, feces, sweat, and urine.

c. Neuromuscular irritability is inversely related to blood-calcium concentration—neuromuscular irritability _____ when the blood concentration of calcium decreases.

Objective 11 Define common disorders and abnormalities associated with the hormones of the parathyroid glands. Write your answers on the blank lines provided beside each of the terms below.

a. Hypocalcemic tetany _____

_____

_____

_____

_____

b. Hypercalcemia _____

_____

_____

_____

_____

Objective 12 Complete statements that describe the structure and function of the adrenal glands. Write your answers on the blank lines provided in the statements below.

a. Each of the two adrenal glands consists of a _____ and a _____ that function independently.

b. The adrenal _____ is essential to life because the hormones it secretes assist the body in adapting to the constant changes in the environment.

c. The adrenal _____ is not essential to life, but the hormones it secretes function in conjunction with the sympathetic nervous system to help individuals meet certain types of emergency situations.

d. Complete removal of both _____ would result in death unless substitute hormones are administered to the individual.

OBJECTIVE 13

Match the primary hormones of the adrenal glands to their correct functions. Write the numbers on the blanks provided.

_____ a. Functions in conjunction with cortisol to regulate metabolism

_____ b. Regulates the metabolism of sodium, chloride, and potassium and, therefore, regulates the water and electrolyte balance of the body

_____ c. Constricts arterioles and venules, which results in increased resistance to blood flow, elevated blood pressure, and slowing of the heart

_____ d. Produces changes in the uterine lining in the second half of the menstrual cycle, promotes the maintenance of pregnancy, promotes the development of the maternal placenta, and promotes the development of mammary glands

_____ e. Regulate the development and maintenance of male sexual characteristics

_____ f. Narrows blood vessels, increases heart activity, dilates bronchi, increases the level of glucose in the blood by stimulating the liver, increases the amount of fatty acid in the blood, and diminishes the activity of the gastrointestinal system

_____ g. Regulate the development and maintenance of female sexual characteristics and the cyclic changes in the vagina and uterus

_____ h. Improves the body's efficiency in using nutrients

1. Aldosterone
2. Androgens
3. Corticosterone
4. Cortisol
5. Epinephrine
6. Estrogens
7. Norepinephrine
8. Progesterone

OBJECTIVE 14

Define common disorders and abnormalities associated with the hormones of the adrenal glands. Write your answers on the blank lines provided beside each of the terms below.

a. Addison's disease _____

_____

_____

_____

b. Cushing's syndrome _____

_____

_____

_____

Objective 15

Complete statements that describe the function of the gonads. Write your answers on the blank lines provided in the statements below.

a. The ovaries (female gonads) secrete several hormones, including _____ and _____.

b. Estrogens, such as the hormones _____ and _____, are responsible for female sexual characteristics and for the cyclic changes in the vagina and uterus.

c. _____ is responsible for the changes in the uterine lining in the second half of the menstrual cycle, for development of the maternal placenta, and for the development of the mammary glands.

d. The testes (male gonads) secrete androgens including _____ and _____, which regulate the development and maintenance of male sexual characteristics.

Objective 16

Describe the common disorders and abnormalities associated with the hormones of the gonads. Write your answer on the blank lines provided below.

_____

_____

_____

_____

Objective 17

Complete statements that describe the function of the pancreas (islets of Langerhans). Write your answers on the blank lines provided in the statements below and on the next page.

a. The islets of Langerhans of the pancreas manufacture the hormones _____ and _____.

b. _____ is necessary for the normal use of glucose in the body and increases the rate of glucose metabolism.

c. Decreased production of _____ metabolizes glucose too slowly or not at all, and glucose is excreted in the _____.

d. Increased production of _____ metabolizes glucose too fast.

e. Glucagon serves as an antagonist to _____ since it accelerates the conversion of glycogen to _____ in the liver.

f. Glucagon tends to _____ the blood-glucose concentration

OBJECTIVE 18 Define common disorders and abnormalities associated with the hormones of the pancreas (islets of Langerhans). Write your answers on the blank lines provided beside each of the terms below.

a. Diabetes mellitus _____

_____

_____

_____

_____

b. Hypoglycemia _____

_____

_____

_____

_____

OBJECTIVE 19 Complete statements that describe the function of the pineal body. Write your answers on the blank lines provided in the statements below.

a. The pineal body influences _____, _____, and _____ development during the first seven years of life and then becomes inactive.

b. The pineal body synthesizes the hormone _____, which exerts an inhibitory effect on the gonads.

c. The pineal body is thought to play a note in the disorder called the _____, which is an emotional depression associated with the winter, when the pineal body's secretion of _____ increases.

Objective 20

Complete statements that describe the function of the thymus gland. Write your answers on the blank lines provided in the statements below.

a. The thymus gland produces hormones that stimulate the production of the small _____ that function in the body's defense against infection, especially in the immune response of newborns.

b. The thymus gland secretes a hormone called _____, which promotes the growth of peripheral lymphoid tissue.

c. The thymus gland is most active during _____ life and _____, and it decreases in size after puberty.

d. An enlarged thymus gland in an infant can cause impaired _____ and _____.

e. A person can have the thymus gland removed without serious consequences, but removal of the gland may result in the person having an increased susceptibility to _____.

Objective 21

Complete statements that describe the endocrine functions of organs in the body that are not classified as endocrine glands. Write your answers on the blank lines provided in the statements below.

a. The _____ becomes a temporary endocrine gland during pregnancy; it secretes chorionic gonadotropins, estrogens, and progesterones at levels that delay menstruation.

b. The _____ secretes gastrin from its walls, which is a hormone that stimulates the secretion of gastric juice.

c. The _____ secretes secretin, which is a hormone that stimulates the secretion of pancreatic juices and bile.

Answers to Written Test

OBJECTIVE 1

The network of ductless glands and other structures that elaborate and secrete hormones directly into the bloodstream, affecting the function of specific target organs

OBJECTIVE 2

Answers may appear in any order.

a. Rate of metabolism
b. Metabolism of specific substances such as carbohydrates and calcium
c. Growth and development processes
d. Secretion of other hormones
e. Development and functioning of the reproductive organs
f. Sexual characteristics and libido
g. Development of higher mental functions
h. Ability of the body to meet conditions of stress
i. Resistance to disease

OBJECTIVE 3

a. 7	d. 1	g. 8
b. 3	e. 6	h. 2
c. 5	f. 4	

OBJECTIVE 4

a. Parathyroid glands
b. Thyroid gland
c. Gonads
d. Pancreas (islets of Langerhans)
e. Adrenal glands
f. Thymus gland
g. Pituitary gland
h. Pineal body

OBJECTIVE 5

a. posterior; anterior
b. posterior
c. posterior
d. anterior
e. anterior; posterior

OBJECTIVE 6

a. 7	d. 5	g. 9
b. 8	e. 1	h. 6
c. 4	f. 3	i. 2

Objective 7

a. A disorder caused by the inadequate secretion of the hormone vasopressin and characterized by the body's production of excessive amounts of urine

b. An abnormality caused by the inadequate secretion of somatotropic hormone and characterized by underdevelopment of the body (extreme shortness of stature)

c. An abnormality caused by the excessive secretion of somatotropic hormone in childhood and characterized by excessive size and stature

d. An abnormality caused by the excessive secretion of somatotropic hormone in adults and characterized by enlargement of the bones of the hands, feet, jaw, and cheeks

Objective 8

a. thyroxine
b. thyroxine
c. Thyroxine
d. protein-bound
e. carbohydrates; fats
f. somatotropic hormone
g. central nervous

Objective 9

a. Any enlargement of the thyroid whether caused by normal or abnormal secretions of thyroxine

b. A disorder characterized by pronounced hyperthyroidism (excessive secretion of thyroxine) usually associated with an enlarged thyroid gland, an abnormal protrusion of the eyeballs, nervousness, a fine tremor of the hands, weight loss, fatigue, and increased heat intolerance

c. A disorder characterized by hypothyroidism (inadequate secretion of thyroxine) in adults and associated with decreased metabolism, increased weight, hair loss, and thickening of the skin due to fluid accumulation

d. A disorder characterized by hypothyroidism (inadequate secretion of thyroxine) in childhood and associated with stunted growth, mental deficiency, puffy facial features, a large tongue, and muscular incoordination

Objective 10

a. parathormone
b. Parathormone; GI; bones; bones; breast milk
c. increases

Objective 11

a. An abnormality in calcium metabolism characterized by inadequate secretion of parathormone and associated with cramps, convulsions, twitching of the muscles, and sharp flexion of the wrist and ankle joints

b. An abnormally high amount of calcium in the blood characterized by excessive secretion of parathormone and associated with confusion, anorexia, abdominal pain, muscle pain, and weakness

Objective 12

a. cortex; medulla
b. cortex
c. medulla
d. adrenal glands

Objective 13

a. 3
b. 1
c. 7
d. 8
e. 2
f. 5
g. 6
h. 4

Objective 14

a. A life-threatening condition caused by partial or complete failure of the function of the adrenal cortex, especially the secretion of aldosterone and the cortisones, as well as melanocyte-stimulating hormone; the condition is characterized by weakness, nausea, weight loss, increased pigmentation of the skin, irregular milk-white patches on the skin, and water and electrolyte disturbances

b. A metabolic disorder due to the excessive secretion of the hormones of the adrenal cortex caused by increased amounts of a hormone secreted by the pituitary; the disorder is characterized by weakness, increased blood pressure, excess fat in the face, protein loss, osteoporosis, amenorrhea, impotence, and excess hair growth

Objective 15

a. estrogens; progesterone
b. estradoil; estrone
c. Progesterone
d. testosterone; androsterone

Objective 16

The disorders and abnormalities caused by the hormones secreted by the gonads are a result of either hyposecretion or hypersecretion of a hormone and result in either under- or over-development of the associated sexual characteristic.

Objective 17

a. insulin; glucagon
b. Insulin
c. insulin; urine
d. insulin
e. insulin; glucose
f. increase

Objective 18

a. A complex disorder of carbohydrate, fat, and protein metabolism that is primarily the result of a relative or complete lack of insulin secretion by the pancreas and is characterized by elevated blood glucose, glucose in the urine, excessive urine production, and excessive thirst

b. A less-than-normal amount of glucose in the blood usually caused by the administration of too much insulin or excessive secretion of insulin by the islet cells of the pancreas; the condition may result in weakness, headache, hunger, visual disturbances, anxiety, personality changes and, if untreated, delirium, coma, and death

Objective 19

a. sexual; skeletal; mental
b. melatonin
c. seasonal affective disorder; melatonin

Objective 20

a. lymphocytes
b. thymosin
c. prenatal; infancy
d. breathing; circulation
e. acute infections

Objective 21

a. placenta
b. stomach
c. small intestine

Answers to Assignment Sheet

Assignment Sheet 1

Case Study 1

a. Charisse Langdon is probably suffering from Cushing's syndrome.

b. The tumor on the pituitary is likely to have led to increased secretion of ACTH in the pituitary and a subsequent increase in cortisol secretion in the adrenal cortex.

c. Treatment will begin with the removal of the tumor followed by monitoring to ensure that the symptoms are relieved.

Case Study 2

a. I-Na Chao is exhibiting ketoacidosis.

b. She requires injections of insulin and intravenous fluids to restore blood volume and to increase the pH of the blood.

Case Study 3

a. Bert McGraw is suffering from Grave's disease.

b. The probable cause is likely to be an autoimmune problem in which his antibodies have attached to TSH receptors on his thyroid. This result is hypersecretion of thyroxine.

c. Medications such as radioactive iodine must be administered.

Case Study 4

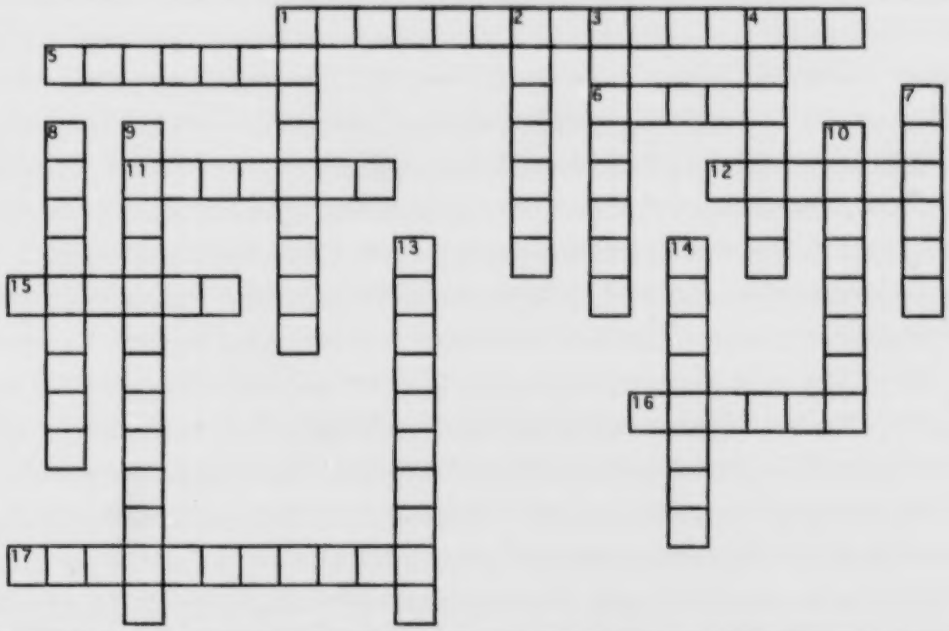
a. George Sanchez appears to have Addison's disease.

b. The adrenal cortex is not secreting adequate amounts of cortisol and aldosterone.

c. Hydrocortisone should be administered.

Crossword Puzzle 1—Terms from Objectives 1 Through 3

Name _____ Date _____



ACROSS

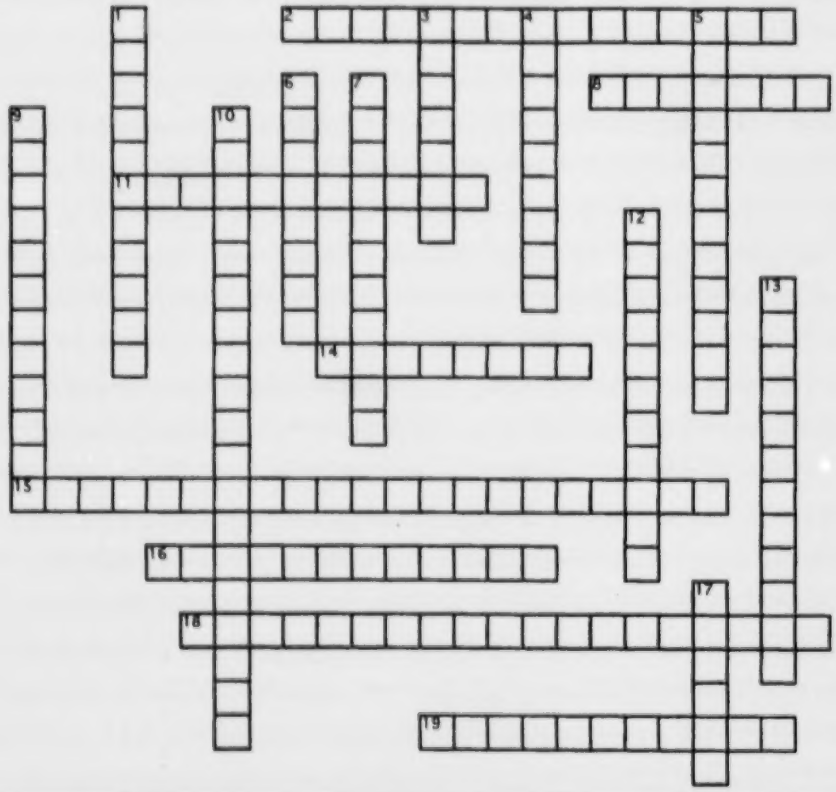
1. The network of ductless glands and other structures that elaborate and secrete hormones directly into the bloodstream, affecting the function of specific target organs (2 words)
5. The endocrine glands that are located superior to the kidneys, each fitting like a cap on the top of each kidney
6. One of the paired essential female reproductive organs that produces eggs
11. A substance containing amino acid that originates in an organ or gland, moves through the blood to another part of the body, and stimulates activity in that region by chemical reaction
12. The generic term for the sex glands of both sexes that produce the cells of reproduction; the ovaries in the female and the testes in the male
15. Sexual drive and energy
16. A glandular structure of largely lymphoid tissue typically located in the upper anterior chest or at the base of the neck
17. The four, small, bean-shaped bodies that lie on the posterior surface of the lobes of the thyroid gland

DOWN

1. To build up in a process by which a gland synthesizes a complex substance from simpler substances and secretes it
2. A narrow structure that joins two other structures
3. A gland that releases a secretion external to or at the surface of an organ by means of a canal or duct
4. A glandular structure consisting of one lobe on either side of the trachea and connected in the midline by the isthmus; the largest of all the endocrine glands
7. One of the paired male reproductive glands that produces sperm and that in most mammals is contained within the scrotum at sexual maturity
8. The endocrine gland that is located at the base of the brain in a small depression of the sphenoid bone of the cerebrum, known as the *sella turcica*; the gland that is sometimes referred to as the *master gland* or *moderator gland* because it affects other glands in the endocrine system
9. Characteristic of or appropriate to an organism's health or normal functioning
10. The fish-shaped, grayish-pink nodular gland that lies inferior to the stomach, functions both as an exocrine and endocrine gland, and contains special cells called the *islets of Langerhans*, which are scattered throughout the gland and produce endocrine secretions
13. The small, conical endocrine gland that lies near the middle of the brain (2 words)
14. Of, relating to, or being tissue (as of the lymph nodes or thymus) containing lymphocytes

Crossword Puzzle 2—Terms from Objective 6

Name _____ Date _____



ACROSS

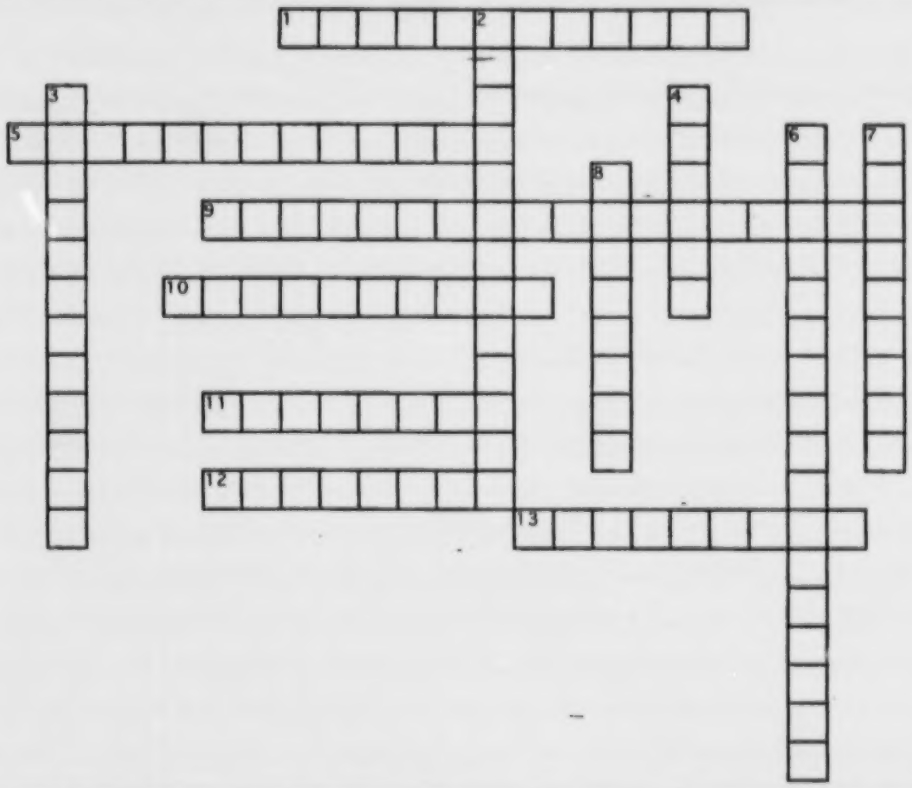
2. The production of sperm cells by the testes
8. Any of the large compound glands that in female mammals are modified to secrete milk
11. The hormone of the anterior lobe of the pituitary gland that regulates the functional activity of the thyroid gland
14. A hormone secreted by a developing ovarian follicle that contributes to the development of female sexual characteristics
15. The hormone of the portion of the pituitary gland between the lobes that influences melanin formation (2 words)
16. A substance that increases reabsorption of water by the nephron tubes and, thus, reduces the amount of urine produced
18. The hormone of the anterior lobe of the pituitary gland that stimulates the development of the ovarian follicles and spermatogenesis in the testes (2 words)
19. The portion of the kidney that transports the urine produced to the urinary tract (2 words)

DOWN

1. The hormone of the anterior lobe of the pituitary gland that maintains the mature corpora lutea, induces the secretion of progesterone, and induces the secretion of milk in a fully developed mammary gland
3. A protein that serves as a pigment to provide color to the skin, hair, and eyes
4. The release of an ovum from an ovary
5. The hormone of the anterior lobe of the pituitary gland that regulates growth
6. The hormone of the posterior lobe of the pituitary gland that stimulates the uterus to contract and acts on the mammary glands to stimulate the release of milk
7. The hormone of the posterior lobe of the pituitary gland that induces the contraction of the smooth muscles of the blood vessels to regulate blood pressure; is associated with an antidiuretic principle that prevents excessive loss of water through the kidneys; causes reabsorption of water in the nephron tubes
9. A temporary endocrine gland formed from an ovarian follicle once an ovum has been released (2 words)
10. The hormone of the anterior lobe of the pituitary gland that regulates the functional activity of the adrenal cortex
12. The hormone of the anterior lobe of the pituitary gland that induces the secretion of estrogens, ovulation, and the development of the corpus luteum
13. A hormone that contributes to the maintenance of pregnancy
17. The womb; the organ of the female for containing and nourishing the young during development previous to birth

Crossword Puzzle 3—Terms from Objectives 7 Through 11

Name _____ Date _____



ACROSS

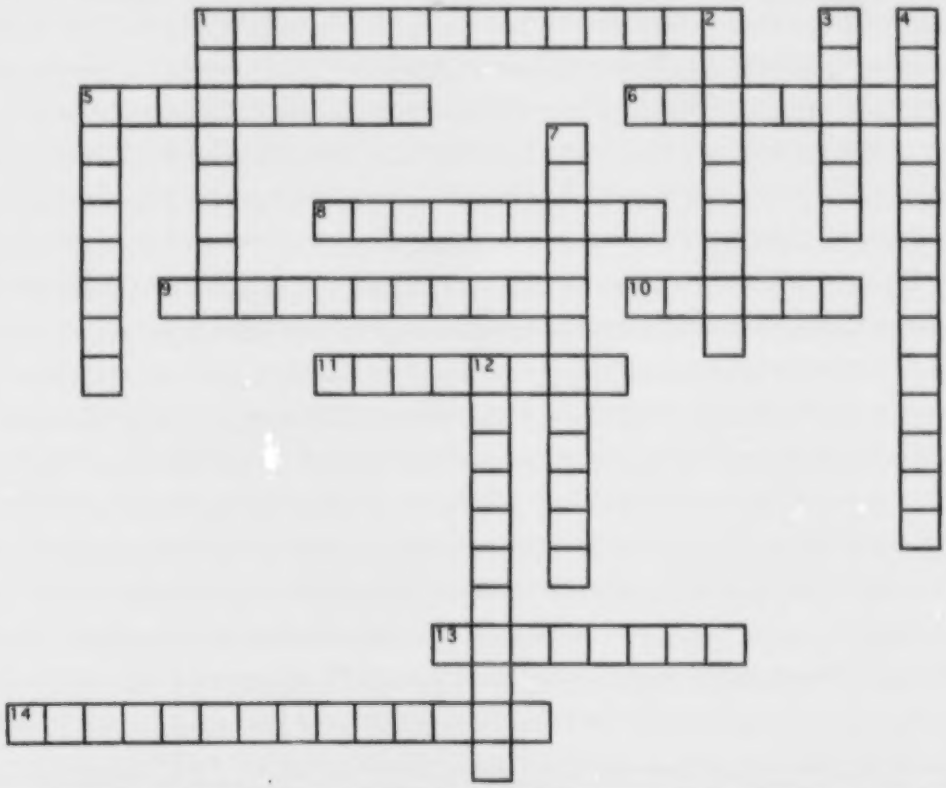
1. The hormone secreted by the parathyroid glands
5. A disorder characterized by pronounced hyperthyroidism usually associated with an enlarged thyroid gland, an abnormal protrusion of the eyeballs, nervousness, a fine tremor of the hands, weight loss, fatigue, and increased heat intolerance (2 words)
9. An abnormality in calcium metabolism characterized by inadequate secretion of parathormone and associated with cramps, convulsions, twitching of the muscles, and sharp flexion of the wrist and ankle joints (2 words)
10. An abnormality caused by the excessive secretion of somatotropic hormone in adults and characterized by enlargement of the bones of the hands, feet, jaw, and cheeks
11. An abnormality caused by the inadequate secretion of somatotropic hormone and characterized by underdevelopment of the body
12. A disorder characterized by hypothyroidism in adults and associated with decreased metabolism, increased weight, hair loss, and thickening of the skin due to fluid accumulation
13. A disorder characterized by hypothyroidism in childhood and associated with stunted growth, mental deficiency, puffy facial features, a large tongue, and muscular incoordination

DOWN

2. An abnormally high amount of calcium in the blood characterized by excessive secretion of parathormone and associated with confusion, anorexia, abdominal pain, muscle pain, and weakness
3. Iodine that is firmly bound to protein in serum and can be used to measure the concentration of circulating thyroxine (2 words)
4. Any enlargement of the thyroid whether caused by normal or abnormal secretions of thyroxine
6. A disorder caused by the inadequate secretion of the hormone vasopressin and characterized by the body's production of excessive amounts of urine (2 words)
7. A hormone of the thyroid gland that influences metabolic rate
8. An abnormality caused by the excessive secretion of somatotropic hormone in childhood and characterized by excessive size and stature

Crossword Puzzle 4—Terms from Objective 13

Name _____ Date _____



ACROSS

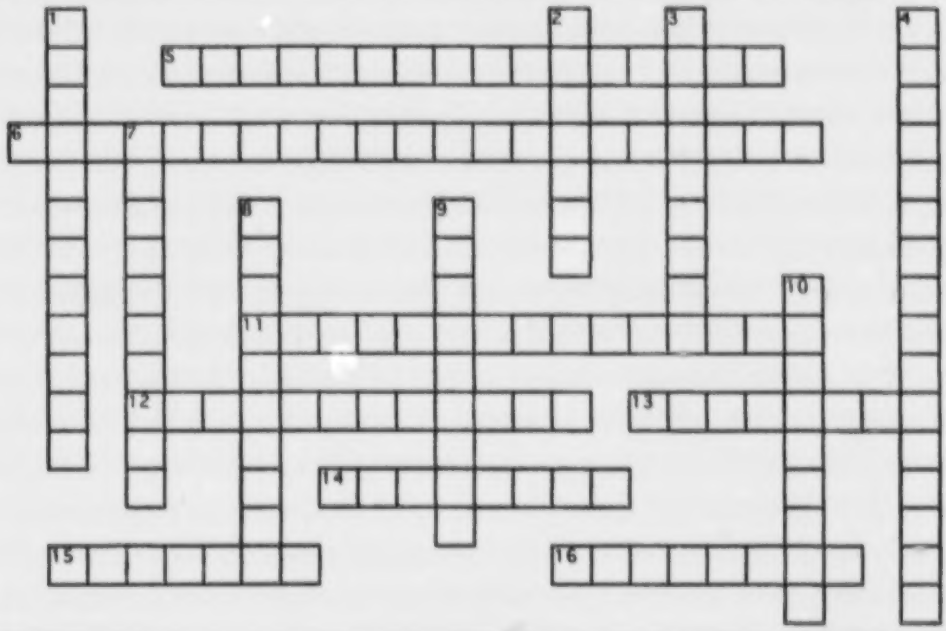
1. The hormone of the adrenal cortex that functions in conjunction with cortisol to regulate metabolism
5. The hormones of the adrenal cortex that regulate the development and maintenance of male sexual characteristics
6. The generic term for the hormone secreted by the ovaries and the adrenal cortices that promote female sexual characteristics
8. Any of the small terminal twigs of an artery that ends in capillaries
9. The hormone of the adrenal cortex that regulates the metabolism of sodium, chloride, and potassium and, therefore, regulates the water and electrolyte balance of the body
10. A small vein; any of the minute veins connecting the capillaries with the larger systemic veins
11. The membrane that forms during pregnancy to serve as an area for exchanging materials between the mother and the fetus
13. Either of the two divisions of the trachea that lead into the right or left lung
14. The hormone of the adrenal medulla that constricts arterioles and venules, which results in increased resistance to blood flow, elevated blood pressure, and slowing of the heart

DOWN

1. The hormone of the adrenal cortex that improves the body's efficiency in using nutrients
2. The hormones of the adrenal cortex that regulate the development and maintenance of female sexual characteristics and the cyclic changes in the vagina and uterus
3. The canal in a female that leads from the uterus to the external orifice of the genital canal
4. The cyclic changes that occur in the female reproductive system during child-bearing years (2 words)
5. The generic term for any hormone or other substance that supports male sexual development
7. The hormone of the adrenal cortex that produces changes in the uterine lining in the second half of the menstrual cycle, promotes the maintenance of pregnancy, promotes the development of the maternal placenta, and promotes the development of mammary glands
12. The hormone of the adrenal medulla that narrows blood vessels, increases heart activity, dilates bronchi, increases the level of glucose in the blood by stimulating the liver, increases the amount of fatty acid in the blood, and diminishes the activity of the gastrointestinal system

Crossword Puzzle 5—Terms from Objectives 14 Through 20

Name _____ Date _____



ACROSS

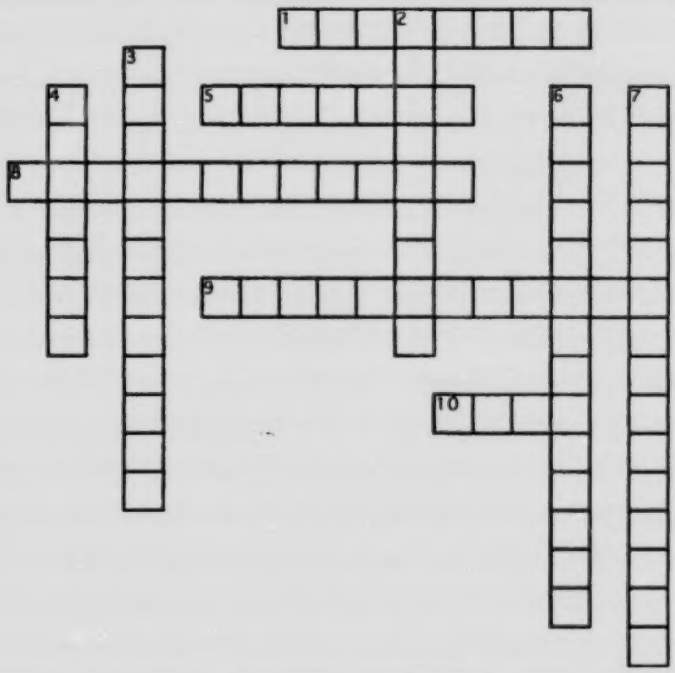
5. A metabolic disorder due to the excessive secretion of the hormones of the adrenal cortex caused by increased amounts of a hormone secreted by the pituitary; the disorder is characterized by weakness, increased blood pressure, excess fat in the face, protein loss, osteoporosis, amenorrhea, impotence, and excess hair growth (2 words)
6. Either of two hormones of the pituitary gland that darken the skin by stimulating melanin dispersion in pigment-containing cells (2 words)
11. A life-threatening condition caused by partial or complete failure of the function of the adrenal cortex, especially the secretion of aldosterone and the cortisones, as well as melanocyte-stimulating hormone; the condition is characterized by weakness, nausea, weight loss, increased pigmentation of the skin, irregular milk-white patches on the skin, and water and electrolyte disturbances (2 words)
12. A less-than-normal amount of glucose in the blood usually caused by the administration of too much insulin or excessive secretion of insulin by the islet cells of the pancreas; the condition may result in weakness, headache, hunger, visual disturbances, anxiety, personality changes and, if untreated, delirium, coma, and death
13. Occurring prior to birth
14. The hormone secreted by the pancreas that serves as an antagonist to insulin
15. The period of human development when a child becomes sexually mature and capable of reproduction
16. The hormone secreted by the thyroid gland that promotes the growth of peripheral lymphoid tissue

DOWN

1. A weakened condition of the bones due to a loss of matrix that is not replaced
2. The hormone secreted by the pancreas that is necessary for the normal use of glucose in the body and increases the rate of glucose metabolism
3. A secretion of the adrenal cortex used especially in the treatment of rheumatoid arthritis
4. A complex disorder of carbohydrate, fat, and protein metabolism that is primarily the result of a relative or complete lack of insulin secretion by the pancreas and is characterized by elevated blood glucose, glucose in the urine, excessive urine production, and excessive thirst (2 words)
7. An absence of menstruation
8. An agent that works against or in opposition to another agent
9. An inability for a man to become sexually aroused and to perform sexually
10. The hormone secreted by the pineal body that exerts an inhibitory effect on the gonads

Crossword Puzzle 6—Terms from Objective 21

Name _____ Date _____



ACROSS

1. A temporary endocrine gland during pregnancy; it secretes chorionic gonadotropins, estrogens, and progesterones at levels that delay menstruation
5. The highly vascular outer embryonic membrane that in placental mammals is associated with the formation of the placenta
8. A gonadotropic hormone
9. A thin, watery, acidic digestive fluid (2 words)
10. A yellow or greenish fluid secreted by the liver that aids in the absorption of fats

DOWN

2. Of, relating to, or being part of the chorion; secreted or produced by chorionic or related tissue
3. Acting on or stimulating the gonads
4. The organ that secretes gastrin from its walls, which is a hormone that stimulates the secretion of gastric juice
6. The organ that secretes secretin, which is a hormone that stimulates the secretion of pancreatic juices and bile (2 words)
7. A clear secretion of pancreatic enzymes that acts on food already acted on by gastric juice and saliva (2 words)

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. ENDOCRINE SYSTEM
5. ADRENAL
6. OVARY
11. HORMONE
12. GONADS
15. LIBIDO
16. THYMUS
17. PARATHYROID

DOWN
1. ELABORATE
2. ISTHMUS
3. EXOCRINE
4. THYROID
7. TESTIS
8. PITUITARY
9. PHYSIOLOGICAL
10. PANCREAS
13. PINEAL BODY
14. LYMPHOID

Crossword Puzzle 2

ACROSS
2. SPERMATOGENESIS
8. MAMMARY
11. THYROTROPIC
14. ESTROGEN
15. MELANOCYTE STIMULATING
16. ANTIDIURETIC
18. FOLLICLE STIMULATING
19. NEPHRON TUBE

DOWN
1. LUTEOTROPIC
3. MELANIN
4. OVULATION
5. SOMATOTROPIC
6. OXYTOCIN
7. VASOPRESSIN
9. CORPUS LUTEUM
10. ADRENOCORTICOTROPIC
12. LUTEINIZING
13. PROGESTERONE
17. UTERUS

Crossword Puzzle 3

ACROSS
1. PARATHORMONE
5. GRAVES DISEASE
9. HYPOCALCEMIC TETANY
10. ACROMEGALY
11. DWARFISM
12. MYXEDEMA
13. CRETINISM

DOWN
2. HYPERCALCEMIA
3. PROTEIN BOUND
4. GOITER
6. DIABETES INSIPIDUS
7. THYROXINE
8. GIANTISM

Crossword Puzzle 4

ACROSS
1. CORTICOSTERONE
5. ANDROGENS
6. ESTROGEN
8. ARTERIOLE
9. ALDOSTERONE
10. VENULE
11. PLACENTA
13. BRONCHUS
14. NOREPINEPHRINE

DOWN
1. CORTISOL
2. ESTROGENS
3. VAGINA
4. MENSTRUAL CYCLE
5. ANDROGEN
7. PROGESTERONE
12. EPINEPHRINE

Crossword Puzzle 5

ACROSS
5. CUSHINGS SYNDROME
6. MELANOCYTE STIMULATING
11. ADDISONS DISEASE
12. HYPOGLYCEMIA
13. PRENATAL
14. GLUCAGON
15. PUBERTY
16. THYMOSIN

DOWN
1. OSTEOPOROSIS
2. INSULIN
3. CORTISONE
4. DIABETES MELLITUS
7. AMENORRHEA
8. ANTAGONIST
9. IMPOTENCE
10. MELATONIN

Crossword Puzzle 6

ACROSS
1. PLACENTA
5. CHORION
8. GONADOTROPIN
9. GASTRIC JUICE
10. BILE

DOWN
2. CHORIONIC
3. GONADOTROPIC
4. STOMACH
6. SMALL INTESTINE
7. PANCREATIC JUICE

Module Review

Name _____

Date _____ Score _____

Directions Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 20

1. The thymus gland secretes a substance called _____ that promotes the growth of peripheral _____ tissue.

   a. *thymosin*; nerve

   b. *thymosin*; lymphoid

   c. *thymogen*; nerve

   d. *thymogen*; lymphoid

Objective 6

2. Which of the following hormones of the pituitary gland induces the secretion of estrogens, ovulation, and the development of the corpus luteum?

   a. thyrotropic hormone

   b. follicle-stimulating hormone

   c. luteinizing hormone

   d. luteotropic hormone

Objective 18

3. _____ is a condition caused by excessive secretion of insulin by the pancreas, resulting in weakness, headache, hunger, and visual disturbances.

   a. Diabetes mellitus

   b. Diabetes insipidus

   c. Hypoglycemia

   d. Hyperglycemia

Objective 8

4. Thyroid hormones _____.

   a. affect somatotropic hormone secretion and function

   b. aid in regulating metabolism, especially carbohydrates and fats

   c. both "a" and "b"

   d. neither "a" nor "b"

Objective 2

5. Which of the following is NOT a physiological characteristic affected by hormones?

   a. sexual characteristics and libido

   b. development and functioning of the digestive organs

   c. ability of the body to meet conditions of stress

   d. resistance to disease

Objective 19

6. The pineal body synthesizes the hormone _____, which exerts an inhibitory effect on the gonads.

   a. estrogen

   b. androgen

   c. indrogen

   d. melatonin

Objective 17

7. _____ is a hormone produced by the pancreas that accelerates the conversion of glycogen to glucose in the liver.

   a. Glucagon

   b. Indrogen

   c. Gludrogen

   d. Insulin

Objective 21

8. The stomach secretes _____ from its walls to stimulate the secretion of gastric juice.

   a. gastrin

   b. secretin

   c. glandin

   d. intestin

Objective 3

9. The pituitary gland is located at the base of the brain in a small depression of the _____ of the cerebrum known as the *sella turcica*.

   a. cranium

   b. longitudinal fissure

   c. medulla oblongata

   d. sphenoid bone

Objective 4

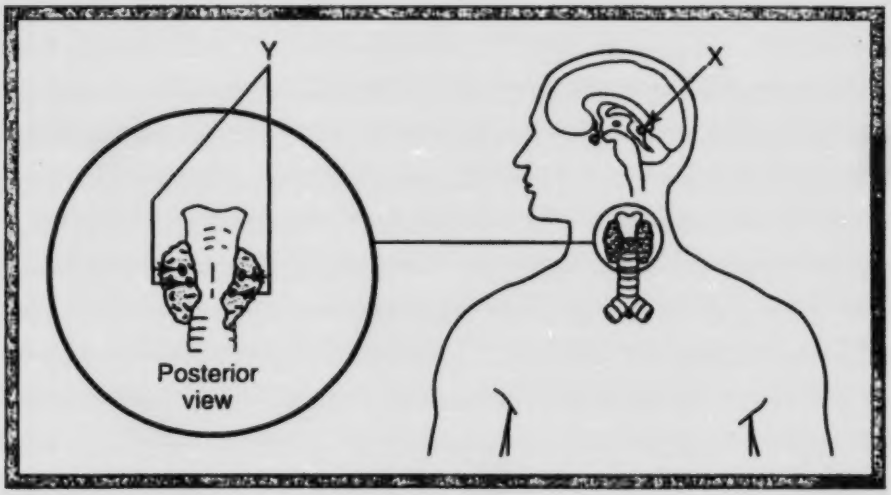
10. What endocrine gland is indicated by the letter "X" in the illustration below?

   a. thyroid

   b. pineal body

   c. thymus

   d. pituitary



Objective 4

11. What endocrine gland(s) is indicated by the letter "Y" in the illustration above?

   a. parathyroid glands

   b. adrenal glands

   c. pancreas

   d. gonads

Objective 5

12. The pituitary gland is divided into _____.

    a. anterior and posterior lobes

    b. medial and lateral halves

    c. dorsal and ventral sections

    d. quadrants by fissures

Objective 15

13. Which of the following hormones is NOT secreted by the testes?

    a. progesterone

    b. androgens

    c. testosterone

    d. androsterone

Objective 6

14. Which of the following hormones of the pituitary gland induces contraction of the smooth muscles of the blood vessels to regulate blood pressure; is associated with an antidiuretic principle that prevents excessive loss of water through the kidneys; and causes reabsorption of water in the nephron tubes?

    a. vasopressin

    b. oxytocin

    c. somatotropic hormone

    d. adrenocorticotropic hormone

Objective 1

15. _____ is a substance containing amino acid that originates in an organ or gland.

    a. A hormone

    b. A libido

    c. A sella turcica

    d. An isthmus

Objective 6

16. What is the purpose of melanocyte-stimulating hormone?

    a. causes melanocytes to grow larger

    b. influences melanin formation

    c. suppresses the development of melanocytes

    d. regulates the functioning of the thyroid

Objective 13

17. _____ are hormones secreted by the adrenal cortex that help regulate metabolism and improve the body's efficiency in using nutrients.

a. Cortisol and corticosterone

b. Androgens and estrogens

c. Epinephrine and norepinephrine

d. Estrogens and progesterones

Objective 12

18. The adrenal glands consist of a cortex and a medulla that function _____.

a. only during childhood

b. synchronously

c. independently

d. as a single organ

Objectives 3 & 8

19. Which of the following is NOT a true statement with regard to the thyroid gland?

a. The thyroid gland is the largest of all endocrine glands.

b. The thyroid gland is a glandular structure consisting of one lobe on either side of the trachea connected in the midline by the isthmus.

c. The thyroid gland secretes thyroxine.

d. The thyroid gland requires the intake of chlorine in order to synthesize thyroxine.

Objective 17

20. The islets of Langerhans of the pancreas manufacture _____ and _____.

a. glucagon; androgen

b. insulin; androgen

c. insulin; glucagon

d. indrogen; gludrogen

Objective 13

21. Which of the following hormones is secreted by the adrenal medulla?

a. aldosterone

b. norepinephrine

c. corticosterone

d. cortisol

Objective 2

22. Which of the following is NOT a physiological characteristic affected by hormones?

a. rate of metabolism and metabolism of specific substances such as carbohydrates and calcium

b. growth and development processes

c. secretion of other hormones

d. development of basic instincts

Objective 9

23. _____ is a disorder characterized by pronounced hyperthyroidism usually associated with an enlarged thyroid gland, an abnormal protrusion of the eyeballs, nervousness, a fine tremor of the hands, weight loss, fatigue, and increased heat intolerance.

a. Cretinism

b. Goiter

c. Grave's disease

d. Myxedema

Objective 10

24. The parathyroid glands secrete _____.

a. thormone

b. thyroxine

c. insulin

d. parathormone

Objective 12

25. The adrenal medulla is not essential to life, but the hormones it secretes function in conjunction with the _____ to help individuals meet certain types of emergency situations.

a. sympathetic nervous system

b. parasympathetic nervous system

c. central nervous system

d. adrenal cortex

Objective 13

26. _____ are hormones of the adrenal cortex that help in the development of male sexual characteristics.

a. Progesterones

b. Androgens

c. Estrogens

d. Epinephrine and norepinephrine

Objective 10

27. Neuromuscular irritability is inversely related to blood-calcium concentration—that is, neuromuscular irritability increases when the blood concentration of _____.

    a. calcium decreases

    b. calcium increases

    c. potassium decreases

    d. potassium increases

Objective 9

28. Any enlargement of the thyroid whether caused by normal or abnormal secretions of thyroxine is _____.

    a. cretinism

    b. goiter

    c. Grave's disease

    d. myxedema

Objective 11

29. An abnormally high amount of calcium in the blood characterized by excessive secretion of parathormone and associated with confusion, anorexia, abdominal pain, muscle pain, and weakness is called _____.

    a. *hypocalcemia*

    b. *hypocalcemic tetany*

    c. *hypercalcemia*

    d. *hypercalcemic tetany*

Objective 7

30. What is the cause of diabetes insipidus?

    a. inadequate secretion of vasopressin

    b. excessive secretion of vasopressin

    c. inadequate secretion of somatotropic hormone

    d. excessive secretion of somatotropic hormone

Objective 12

31. The adrenal cortex is essential to life because it assists the body to _____.

    a. adapt to the constant changes in the environment

    b. rest during periods of sleep

    c. control the secretions of all other endocrine glands

    d. control the secretions of the ducted glands

Objective 9

32. _____ is a condition caused by hypothyroidism in adults and characterized by decreased metabolism, increased weight, hair loss, and thickening of the skin due to fluid accumulation.

a. Cretinism

b. Goiter

c. Grave's disease

d. Myxedema

Objective 12

33. Complete removal of both adrenal glands would result in death _____.

a. because blood is produced in the adrenals

b. because the adrenals control all other gland systems

c. unless the adrenals have already stopped functioning due to age

d. unless substitute hormones are administered to the individual

Objective 8

34. Thyroid function can be indicated by the measurement of _____ in the plasma.

a. plasma-based indicators

b. protein-bound iodine

c. parathyroid blood inhibitors

d. passive buffered insulin

Objective 9

35. Hypothyroidism in childhood characterized by stunted growth and mental deficiency is referred to as _____.

a. *cretinism*

b. *goiter*

c. *Grave's disease*

d. *myxedema*

Objective 6

36. Which of the following hormones is secreted by the anterior lobe of the pituitary gland?

a. somatotropic hormone

b. vasopressin

c. oxytocin

d. melanocyte-stimulating hormone

Objective 13

37. _____ is a hormone of the adrenal medulla that narrows blood vessels, increases heart activity, dilates bronchi, increases the level of glucose in the blood by stimulating the liver, increases the amount of fatty acid in the blood, and diminishes the activity of the gastrointestinal system.

a. Norepinephrine

b. Epinephrine

c. Aldosterone

d. Progesterone

Objective 14

38. _____ is characterized by hypofunction of the adrenal cortex, especially aldosterone and the cortisones, as well as melanocyte-stimulating hormone; the condition is characterized by weakness, nausea, weight loss, increased pigmentation of skin, irregular milk-white patches on the skin, and water and electrolyte disturbances.

a. Parkinson's disease

b. Addison's disease

c. Huntington's disease

d. Cushing's disease

Objective 5

39. The posterior lobe of the pituitary gland is connected to the _____.

a. hypothalamus

b. thymus

c. thalamus

d. spinal cord

Objective 16

40. Hypersecretion of the hormones of the gonads is most likely to result in _____.

a. underdevelopment of sexual characteristics

b. overdevelopment of sexual characteristics

c. an enlarged head and hands

d. an abnormally small head and hands

Objective 8

41. Thyroxine is transported in the blood by binding itself to _____.

a. red blood cells

b. white blood cells

c. plasma

d. proteins

Objective 17

42. _____ is a hormone produced by the pancreas that is necessary for the normal use of glucose in the body and increases the rate of glucose metabolism.

a. Glucagon

b. Indrogen

c. Gludrogen

d. Insulin

Objective 3

43. The _____ glands are located superior to the kidneys, each fitting like a cap on the top of each kidney.

a. parathyroid

b. adrenal

c. gonad

d. thyroid

Objective 2

44. Which of the following is NOT affected by the hormones of the endocrine system?

a. the secretion of other hormones

b. the absorbtion of toxins

c. the ability of the body to meet conditions of stress

d. the resistance to disease

Objective 19

45. The pineal body influences sexual, skeletal, and mental development in the first _____ years of life and then becomes inactive.

a. five

b. seven

c. twelve

d. sixteen

Objective 3

46. The thyroid gland consists of two lobes connected in the midline by the _____.

a. lymphoid tissue

b. islets of Langerhans

c. nephron tube

d. isthmus

Objective 19

47. Seasonal affective disorder results from _____.

a. increased secretion by the pineal body during the winter

b. decreased secretion by the pineal body during the winter

c. increased secretion by the pineal body during the summer

d. decreased secretion by the pineal body during the summer

Objective 1

48. The network of ductless glands and other structures that elaborate and secrete hormones directly into the bloodstream, affecting the function of specific target organs is the _____ system.

a. pituitary

b. adrenal

c. endocrine

d. physiological

Objective 21

49. The placenta becomes a temporary endocrine gland during pregnancy and secretes chorionic gonadotropins, estrogens, and progesterones at levels that delay _____.

a. development of the fetal head

b. development of the fetal body

c. delivery until the fetus is fully developed

d. menstruation

Objective 3

50. The _____ is the fish-shaped gland that lies inferior to the stomach and functions both as an exocrine and endocrine gland.

a. pancreas

b. pineal body

c. thymus

d. thyroid gland

Answers to Module Review

1. b	11. a	21. b	31. a	41. d
2. c	12. a	22. d	32. d	42. d
3. c	13. a	23. c	33. d	43. b
4. c	14. a	24. d	34. b	44. b
5. b	15. a	25. a	35. a	45. b
6. d	16. b	26. b	36. a	46. d
7. a	17. a	27. a	37. b	47. a
8. a	18. c	28. b	38. b	48. c
9. d	19. d	29. c	39. a	49. d
10. b	20. c	30. a	40. b	50. a

MODULE SET II:
Major Body Systems

Module 6: Special Senses

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Special Senses	9
2—Major Structures of the Eye	11
3—Lacrimal Apparatus	13
4—Major Sections and Structures of the Ear	15
5—Major Structures of the Nose and Mouth	17
Written Test	19
Answers to Written Test	35
Answers to Assignment Sheet	41
Crossword Puzzles	
1—Terms from Objectives 1 Through 4	43
2—Terms from Objective 5	45
3—Terms from Objectives 6 Through 9	47
4—Terms from Objective 10	49
5—Terms from Objectives 11 and 12	51
6—Terms from Objectives 13 and 14	53
7—Terms from Objectives 15 Through 18	55
8—Terms from Objectives 19 Through 25	57
Answers to Crossword Puzzles	59
Module Review	61
Answers to Module Review	77

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activity Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 6 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module builds on Module 4. You may wish to review the nervous system as you begin this lesson.

- Introduce the module by asking the students to listen carefully to sounds around them. Within a few moments, they should become aware of sounds that they had not noticed a few minutes before, such as birds or traffic beyond the windows or other students in the hall. Use this realization to reinforce the idea that "hearing" actually takes place in the brain, as do the other sensations. Continue the exercise by increasing the students' awareness of other sensations that they are experiencing, such as sights, odors, the feel of their desks or clothing, the temperature in the room, etc. Ask the students to describe how they perceive and recognize those sensations—such as perceiving light and recognizing the color red or the detecting of an odor and recognizing the scent of a specific cologne. Take the students farther into this expedition by asking them what else they feel—such as hunger or thirst. Then ask them to describe where their feet are and how they are positioned without looking. Follow this discussion with a review of Objective 1 and relate the information to the sensations that the students have just explored.
- Use the crossword puzzles to help reinforce the terms in the associated objectives.
- To supplement Objective 2, review the functioning of the nervous system to help the students relate to the three components of a sense organ: receptor, pathway, and sensory center. Use illustrations of the brain to show the sensory centers. Discuss the need for a stimulus and give examples of chemicals (taste and smell) and energies (pressure, light, sound, and heat) that stimulate receptors. Relate these points back to the first objective to lead a discussion of the flow of information from stimulus through receptor and pathway to sensory center. Use blindfolded students to demonstrate that the students have learned sensory cues. Expose the students to odors (such as a fresh orange), sounds (flipping the pages of a book), and objects to touch (aluminum foil).

  ✔ **NOTE:** Be sensitive to the feelings of students who may have sensory limitations. This may mean that you will be able to use their enhanced senses to demonstrate sensory compensation.

- Use the following suggestions to supplement Objective 5 through Objective 11.
  - Using models and illustrations, discuss the structure and functioning of the eye. Use binoculars, cameras, magnifying glasses, and other lenses to demonstrate focusing light. Point out that images actually fall on the retina upside-down and are inverted within the brain.
  - If appropriate for your class, dissect cow or pig eyes and explore their structures and humors.

— Review the muscle system and have students identify the muscles of the eye and surrounding areas. Discuss the operation of the muscles in controlling the eye. Have the students classify muscles as intrinsic or extrinsic.

— Discuss the accessory structures of the eye and their role in protecting and lubricating the eyes. Have the students speculate on why it is desirable that the eyes be recessed in the face while the nose and ears extend from the head.

— Discuss the disorders of the eyes. Poll the class to see who is near-sighted and who is far-sighted. Discuss astigmatisms; some students may be familiar with theirs and be able to discuss them. Invite an optometrist or opthamologist to discuss his or her profession with the class. If possible, conduct eye tests of the students, including color blindness. Discuss corrective measures for sight problems, including laser surgery.

- Use the following suggestions to supplement Objective 12 through Objective 18.

— Use illustrations and models to discuss the structure and functioning of the ear. Numerous media presentations exist that describe the transmission of sound and some may be available from other instructors in your facility. Demonstrate sound transmission through objects, including those that transmit well (steel tube) versus those that do not (cotton balls).

— Conduct hearing tests with your students emphasizing high- and low-frequency limitations in hearing. Demonstrate the use of hearing aids and discuss restorative procedures such as cochlear implants.

- Use the following suggestions to supplement Objective 19 through Objective 22.

— Using illustrations and models, discuss the parts and structure of the nose and mouth.

— Discuss the sense of smell. Open a bottle of an aromatic substance such as alcohol in the middle of the room and ask students to raise their hands when they can smell it. Point out that there is a general sequence of recognition from those closest to the source to those farthest away as the molecules spread through the air. There may even be an observable break in which the concentrations of molecules are so small that detection is not possible. Have the students explain these observations.

— Ask students to name foods that they like and dislike. Identify a few foods (such as fish or broccoli or liver) that show up on both lists (like and dislike). Ask students why there would be this divergence. Using blindfolded volunteers, have them taste samples of chocolate, vanilla, and butterscotch puddings with their noses pinched shut and have them identify each flavor. Discuss the implications. Have the students dip moistened toothpicks in salt and touch the toothpicks to the middle and then to the sides of their tongues. Then have them touch the toothpicks to the tips of their tongues to see if they can distinguish the location of salt-sensitive taste buds.

✔ **NOTE:** Other foods, such as ice cream or a hard candy such as Life-Savers, may be substituted for pudding. The important point is that the food have three or more distinguishable flavors and identical textures. It may be necessary to have the volunteers eat a piece of bread or cracker or take a sip of water between samples to avoid confusing the flavors. Also, results can vary based on differences in individual sensitivities, which is why it is preferable to use four or five test subjects.

— Ask the class if any of them have had a local anesthetic or suffered carpal-tunnel syndrome or other experience involving isolated numbness. Invite an anesthesiologist or nurse anesthetist to discuss the use of anesthetics.

- Point out that losses of sensation for all of the special sense organs may be associated with various diseases, conditions, and traumas. Discuss some of these and have the students identify the causative relationships. For example, diabetes can lead to blindness due to damage to the retina and optic nerve. Have the students explore these relationships.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites focus on the special senses. Internet references in other modules concentrate on the systems specific to those modules. The web site references provided in the first module set are more general to anatomy and physiology and may also support this module.

- http://faculty.washington.edu/chudler/bigear.html

  This site provides good graphics and information about the ear and hearing. It has a good section on tinnitus.

- http://library.thinkquest.org/19537/Ear.html

  This site has a good presentation on sound transmission and the parts of the ear.

- http://www.innerbody.com/anim/ear.html

  An excellent animation showing the transmission of sound through the ear is featured on this site.

- http://www.cln.org/themes/hearing.html

  This site provides links to other sites about hearing.

- http://www.theearfound.com/anatomy.html

  This is an interactive site with a very good soundwave demonstration related to hearing.

- http://www.hhmi.org/senses/start.htm

  This is an excellent site with news on current research and related information about seeing, hearing, smelling, and the brain.

- http://ctl.augie.edu/perry/ear/hearmech.htm

  This site offers good detail and a variety of resources about hearing.

- http://www.entnet.org/smelltaste.html

  This site deals with disorders of smell and taste.

- http://www.yorku.ca/eye/eye1.htm

  This site includes a diagram of the eye with links to explanation of the parts of the eye.

- http://www.exploratorium.edu/learning_studio/cow_eye/step01.html

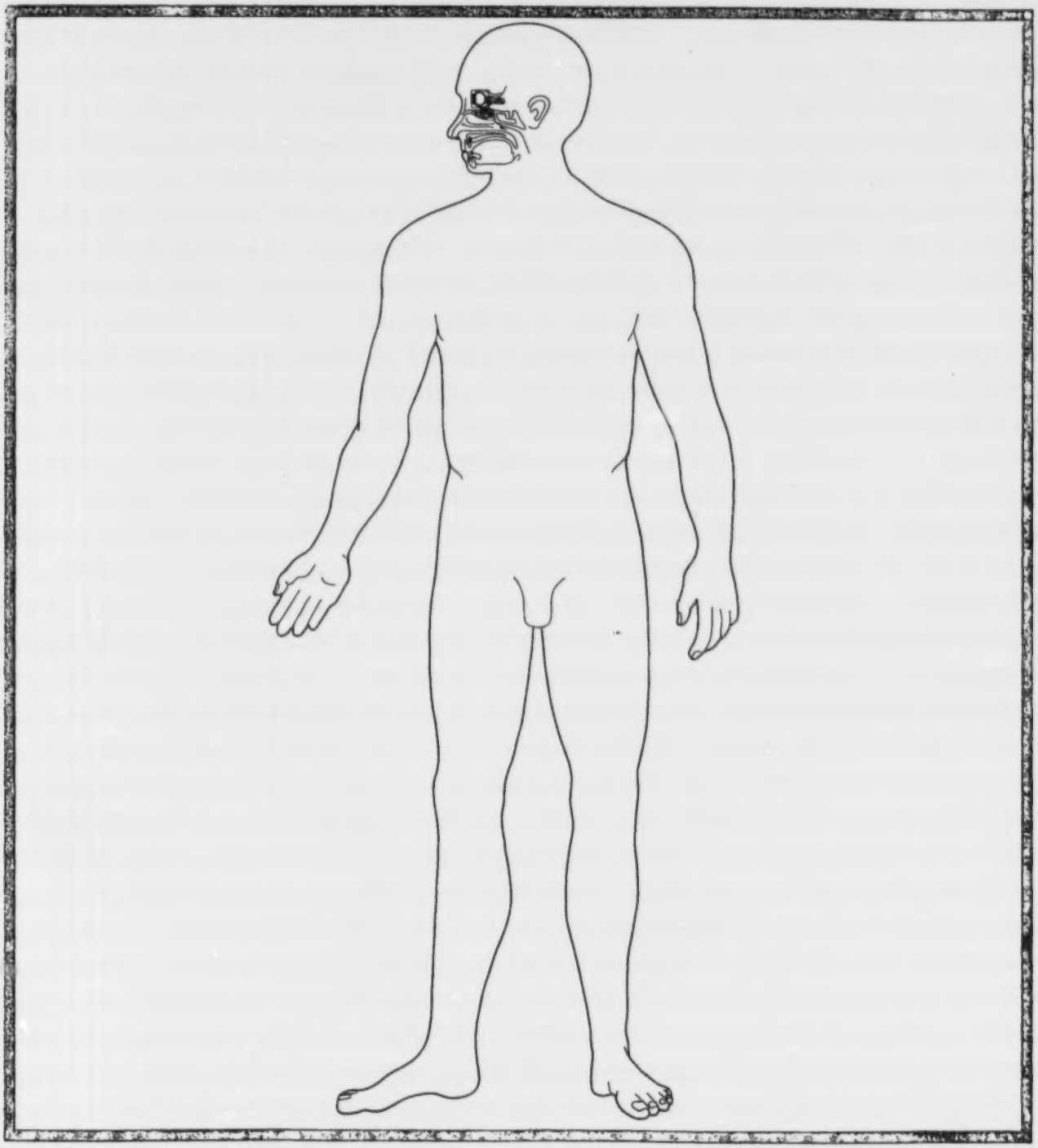
  This page guides the instructor on how to do a dissection of a cow's eye.

- http://blindness.about.com/mbody.htm

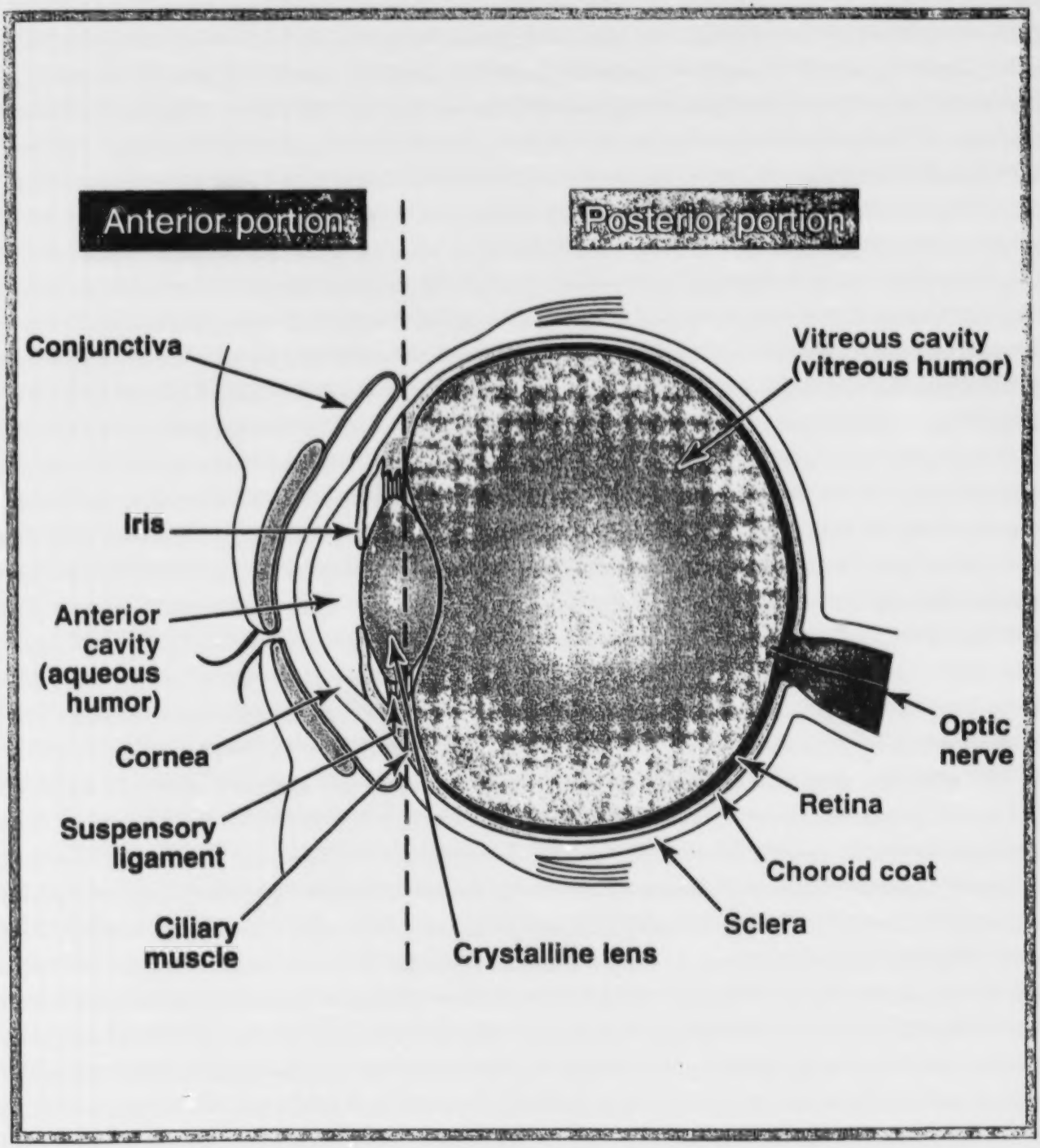
  This site tracks news about eye disorders. The home page addresses many health matters that may be of use in other modules.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

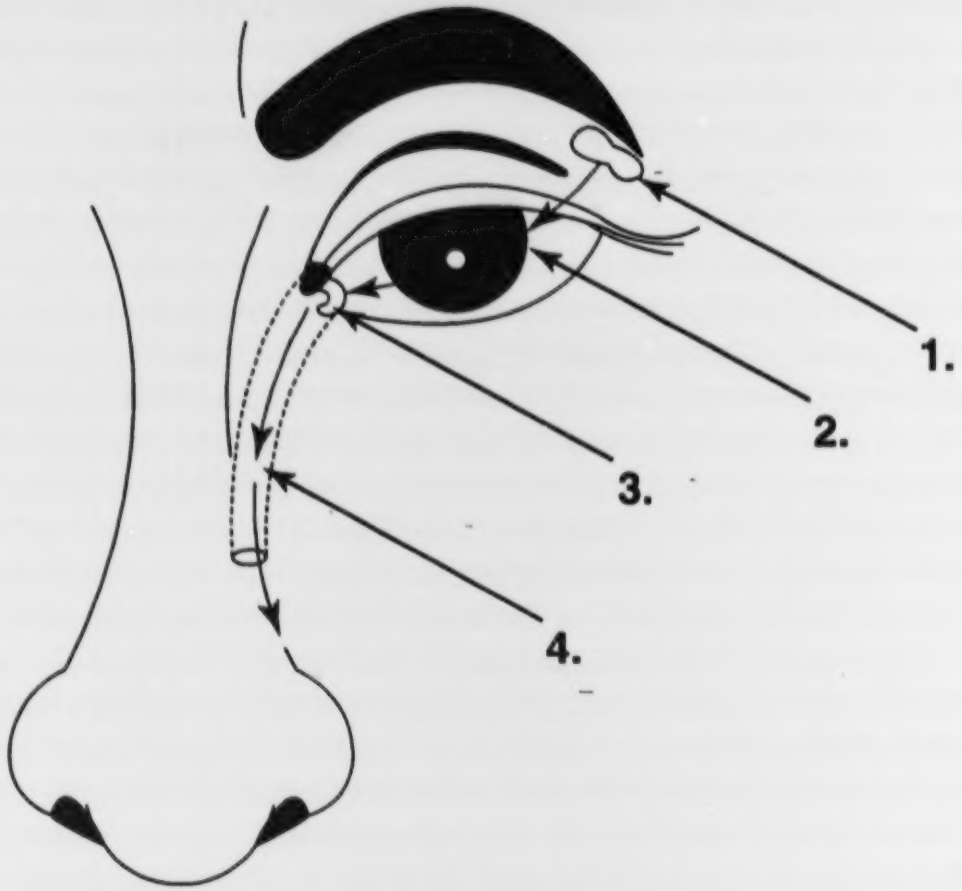
Special Senses



Major Structures of the Eye

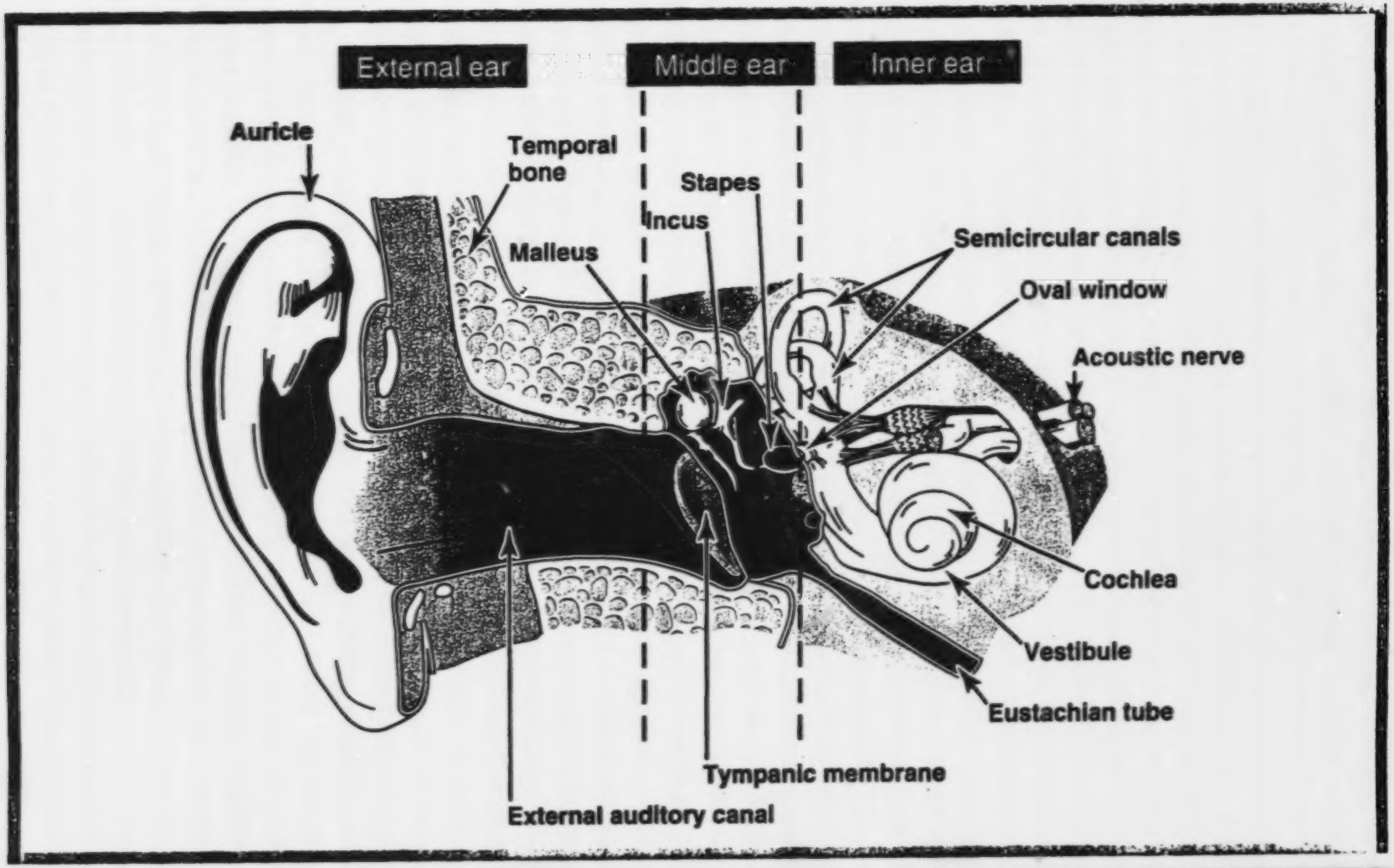


Lacrimal Apparatus

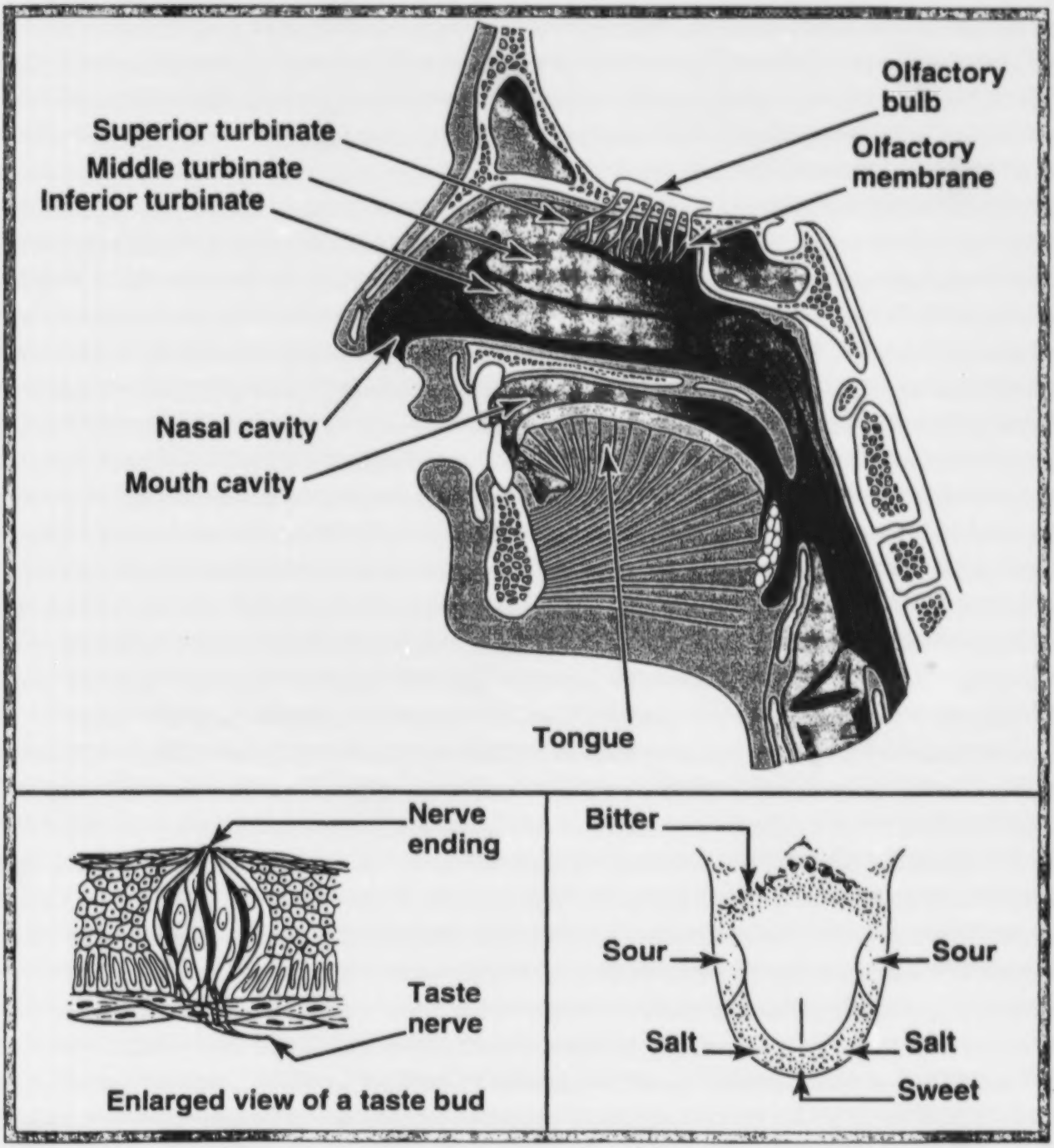


1. The lacrimal gland releases tears into the eye via the lacrimal ducts.
2. Tears wash over the eyeball.
3. Tears leave the eye via the lacrimal canals.
4. Tears wash into the lacrimal sac and then into the nasolacrimal duct that leads into the nasal cavity.

Major Sections and Structures of the Ear



Major Structures of the Nose and Mouth



Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *special sense*. Write your answer on the blank lines provided beside the term below.

Special sense _____

_____

Objective 2 Describe the stages in a sensory response. Write your answers on the blank lines provided beside each of the terms below.

a. Stage 1: Reception _____

_____

_____

b. Stage 2: Transportation _____

_____

_____

c. Stage 3: Sensation _____

_____

_____

Objective 3 Define the major special senses. Write your answers on the blank lines provided beside each of the terms below.

a. Sight _____

_____

b. Hearing _____

_____

c. Smell _____

_____

d. Taste _____

e. Touch _____

OBJECTIVE 4 Define other senses that may also be associated with the special senses. Write your answers on the blank lines provided beside each of the terms below.

a. Hunger _____

b. Thirst _____

c. Equilibrium _____

d. Proprioception _____

OBJECTIVE 5 Define the major layers and cavities of the eye. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Sclera _____

b. Choroid coat _____

c. Retina _____

d. Anterior cavity _____

e. Vitreous cavity _____

_____

_____

OBJECTIVE 6 Complete statements that describe the major muscles of the eye. Write your answers on the blank lines provided in the statements below.

a. The term *extrinsic muscles* refers to the muscles of the eye that are attached to the outside of the _____ and to the bones of the _____.

b. The extrinsic muscles are _____ muscles that move the eyeballs and coordinate the muscles of the separate eyes in order to _____.

c. The term *intrinsic muscles* refers to the muscles of the eye that are located within the _____ of the eye.

d. The intrinsic muscles consist of two _____ muscles: the iris and the ciliary muscle, which adjust _____ entering the eye and allow the eyes to focus on objects at varying distances.

OBJECTIVE 7 Define the major structures of the eye. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Conjunctiva _____

_____

_____

b. Cornea _____

_____

_____

c. Crystalline lens _____

_____

_____

d. Suspensory ligament _____

_____

_____

e. Iris _____

_____

_____

f. Ciliary muscle _____

_____

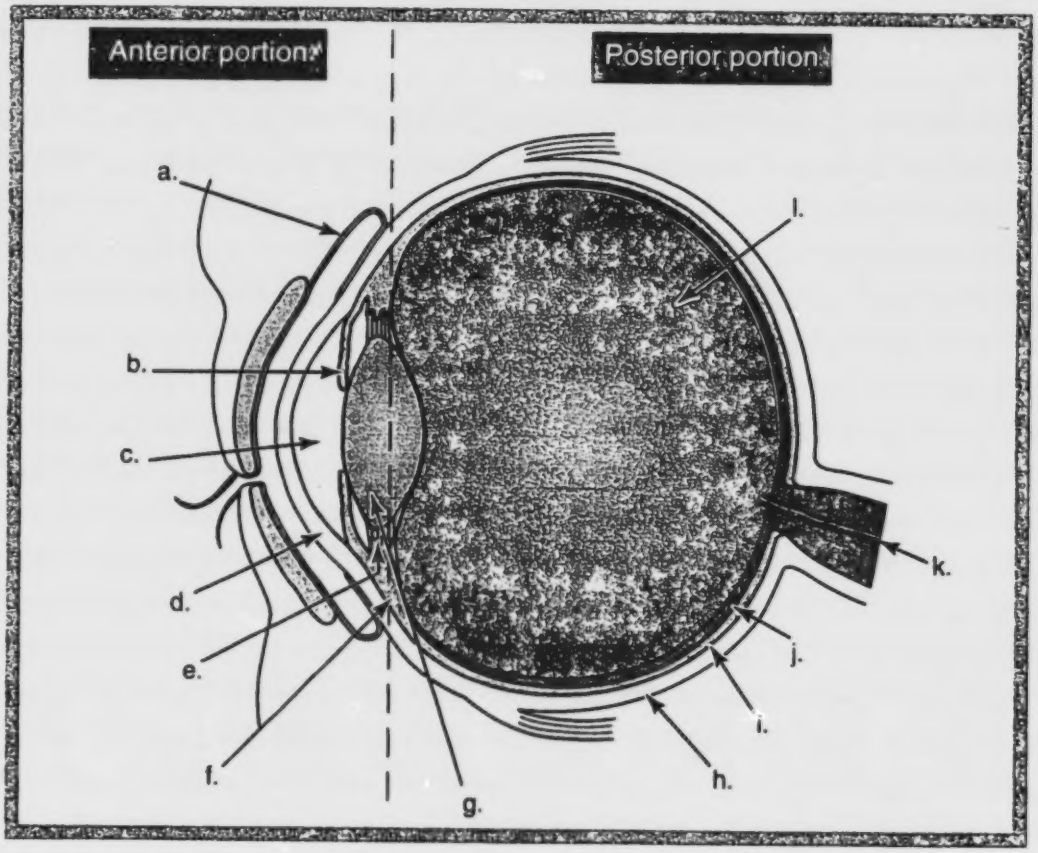
_____

g. Optic nerve _____

_____

_____

OBJECTIVE 8 Label the major structures of the eye. Write your answers on the blank lines provided below the following illustration.



a. _____ g. _____

b. _____ h. _____

c. _____ i. _____

d. _____ j. _____

e. _____ k. _____

f. _____ l. _____

OBJECTIVE 9

Complete statements that describe the sensory response for vision. Write your answers on the blank lines provided in the statements below.

a. The iris functions as a _____; by changing the size of the pupil, the iris regulates the amount of light entering the eye.

b. The _____, _____, and _____ are the structures of the eye that bend the light rays and focus them on the retina.

c. The _____ contains two types of visual receptors: rods and cones.

d. _____ function in dim light and produce black-and-white vision.

e. _____ function in bright light and produce color vision.

f. When stimulated, the rods and cones produce sensory impulses; the sensory impulses are transported to the _____.

g. The _____ transports the sensory impulses to the brain; the brain interprets the sensory impulses as _____.

OBJECTIVE 10

Define the accessory structures of the eye. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Eyebrow _____

b. Eyelash _____

c. Eyelid _____

d. Lacrimal gland _____

e. Lacrimal duct _____

f. Lacrimal canal _____

g. Lacrimal sac _____

h. Nasolacrimal duct _____

Objective 11

Match common disorders and abnormalities of the eye to their correct definitions. Write the numbers on the blanks provided.

_____ a. Farsightedness, a condition caused by the shortening of the eyeball or by an error in refraction so that the light rays entering the eye are focused behind the retina

_____ b. Nearsightedness, a condition caused by the elongation of the eyeball or by an error in refraction so that the light rays entering the eye are focused in front of the retina

_____ c. An inflammation of the conjunctiva caused by bacterial or viral infection, allergy, or environmental factors and characterized by red eyes, a thick discharge, sticky eyelids in the morning, and inflammation without pain

_____ d. An abnormal, progressive condition of the crystalline lens of the eye that is characterized by the loss of transparency

_____ e. Night blindness; poor vision at night or in dim light

_____ f. A chronic, contagious bacterial conjunctivitis characterized by inflammatory granulations that, if left untreated, form follicles on the upper eyelids and grow larger until the granulations invade the cornea, eventually causing blindness

_____ g. An abnormal condition characterized by an inability to clearly distinguish the colors of the spectrum

_____ h. An abnormal condition of elevated pressure within an eye that is caused by the obstruction of the outflow of aqueous humor

_____ i. A condition caused by abnormal curvature of the cornea or crystalline lens so that light rays cannot be focused clearly in a point on the retina

_____ j. A separation of the retina from the choroid in the back of the eye, usually resulting from a hole in the retina that allows the vitreous humor to leak between the choroid and the retina

1. Astigmatism
2. Cataract
3. Color blindness
4. Conjunctivitis
5. Glaucoma
6. Hyperopia
7. Myopia
8. Nyctalopia
9. Retinal detachment
10. Trachoma

OBJECTIVE 12

Define the major sections of the ear. Write your answers on the blank lines provided beside each of the terms below.

a. External ear _____

b. Middle ear _____

c. Inner ear _____

OBJECTIVE 13

Describe the types of conduction used to transmit sound within the ear. Write your answers on the blank lines provided beside each of the terms below.

a. Air conduction _____

b. Bone conduction _____

c. Fluid conduction _____

OBJECTIVE 14

Define the major structures of the ear that function in sound transmission (hearing). Write your answers on the blank lines provided beside each of the terms below and on the following pages.

a. Auricle _____

b. External auditory canal _____

c. Tympanic membrane _____

d. Malleus _____

e. Incus _____

f. Stapes _____

g. Oval window _____

h. Cochlea _____

i. Organ of Corti _____

_____

_____

_____

j. Eustachian tube _____

_____

_____

_____

Objective 15 Define the major structures of the ear that function to maintain equilibrium. Write your answers on the blank lines provided beside each of the terms below.

a. Vestibule _____

_____

_____

b. Semicircular canals _____

_____

_____

Objective 16 Describe the function of the branches of the acoustic nerve (cranial nerve VIII). Write your answers on the blank lines provided beside each of the terms below.

a. Cochlear branch _____

_____

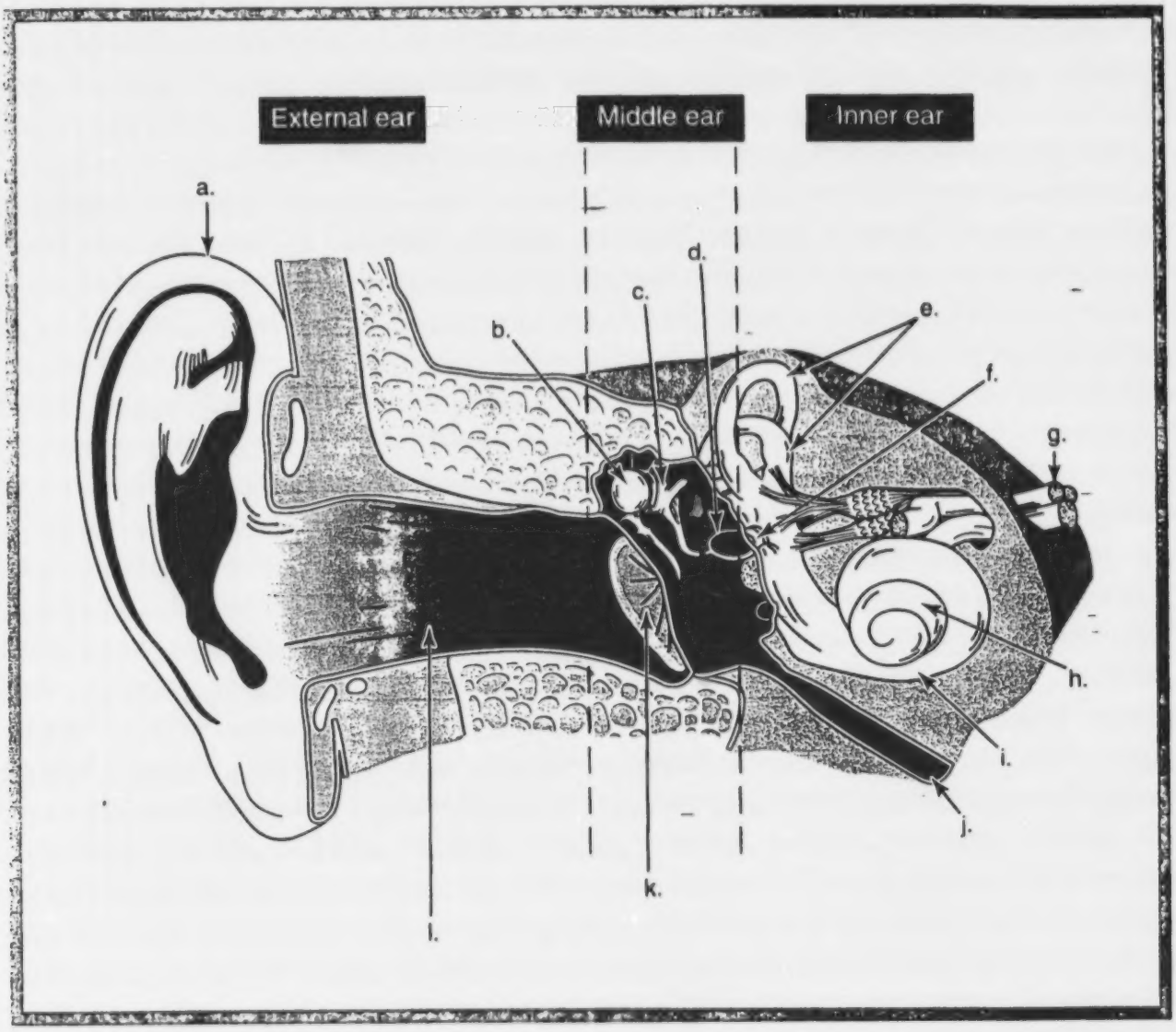
_____

b. Vestibular branch _____

_____

_____

Objective 17 Label the major sections and structures of the ear. Write your answers on the blank lines provided below the following illustration.



a. _____ g. _____

b. _____ h. _____

c. _____ i. _____

d. _____ j. _____

e. _____ k. _____

f. _____ l. _____

OBJECTIVE 18

Define common disorders and abnormalities of the ear. Write your answers on the blank lines provided beside each of the terms below.

a. Otosclerosis _____

b. Otitis externa _____

c. Otitis media _____

d. Presbycusis _____

e. Mènière's disease _____

f. Cerumen impaction _____

OBJECTIVE 19

Complete statements that describe the sensory response for the sense of smell. Write your answers on the blank lines provided in the statements below.

a. The olfactory nerve (cranial nerve I) is composed of fine filaments that are located in the olfactory membrane—the mucous membrane of the _____ of the nasal cavity.

b. The olfactory nerve connects with the _____ and the _____, which are components of the portion of the brain associated with the sense of smell.

Objective 20 Define common disorders and abnormalities associated with the sense of smell. Write your answers on the blank lines provided beside each of the terms below.

a. Anosmia _____

_____

b. Hyperosmia _____

_____

Objective 21 Complete statements that describe the sensory response for the sense of taste. Write your answers on the blank lines provided in the statements below.

a. The receptors for taste are the _____, which are located in the papillae of the tongue.

b. The receptors for salty taste and for sweet taste are localized _____ of the tongue.

c. The receptors for sour taste are localized _____ of the tongue.

d. The receptors for bitter taste are localized _____ of the tongue.

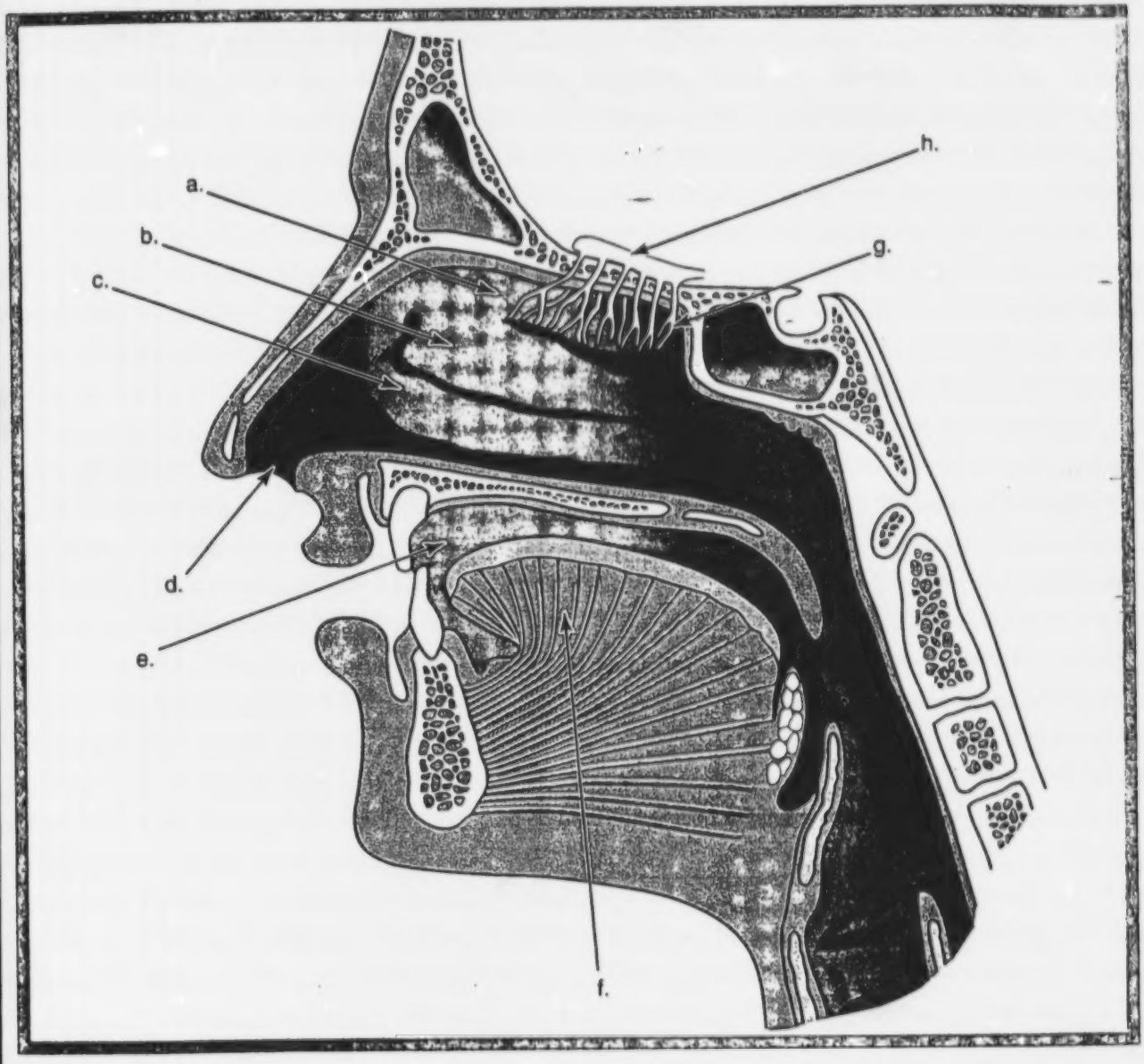
e. The receptors for taste are connected to the branches of cranial nerve _____ and cranial nerve _____.

Objective 22 Define the common disorder associated with the sense of taste. Write your answers on the blank lines provided beside the term below.

a. Ageusia _____

_____

OBJECTIVE 23 Label the major structures of the nose and mouth associated with the senses of smell and taste. Write your answers on the blank lines provided below the following illustration.



a. _____ d. _____ g. _____

b. _____ e. _____ h. _____

c. _____ f. _____

Objective 24

Complete statements that describe the sensory responses for the senses of touch and pain. Write your answers on the blank lines provided in the statements below.

a. Touch is sensed by receptors of _____ that are located in the skin.

b. Some touch receptors provide information about the _____ of the object being touched and some receptors provide information about the amount of _____ being exerted against or by the object being touched.

c. Receptors in the skin also sense the _____ of the air surrounding the body or the _____ of objects the skin contacts.

d. _____ located in the skin and viscera sense pain to provide a warning of potentially harmful conditions.

e. Pain is classified as _____ pain, _____ pain, and _____ pain.

f. _____ pain is sensed in the skin and can be superficial or deep.

g. _____ pain is sensed in the internal organs.

h. _____ pain is pain that exists in an internal organ or deep structure but is felt in another region.

Objective 25

Define common disorders and abnormalities associated with the senses of touch and pain. Write your answers on the blank lines provided beside each of the terms below.

a. Raynaud's syndrome _____

_____

_____

b. Carpal-tunnel syndrome _____

_____

_____

c. Thoracic-outlet syndrome _____

_____

_____

Answers to Written Test

OBJECTIVE 1

The sense of sight, smell, taste, touch, or hearing

OBJECTIVE 2

a. Receptor nerve cells in a receptor organ (eye, ear, nose, etc.) detect a stimulus and generate a sensory impulse.

b. The neural network carries the sensory impulse from the receptor to the brain.

c. The appropriate sensory center in the brain receives the sensory impulse and interprets the impulse as a sensation.

OBJECTIVE 3

a. The visual sense; the special sense that enables the shape, size, position, and color of objects to be perceived; the principal function of the eye

b. The auditory sense; the special sense that enables sound to be perceived; the major function of the ear

c. The olfactory sense; the special sense that enables odors to be perceived through the stimulation of the olfactory nerves; the principal function of the nose

d. The gustatory sense; the special sense of perceiving different flavors—sweet, salty, sour, and bitter—in soluble substances that contact the tongue and trigger nerve impulses to special taste centers in the cortex and the thalamus of the brain

e. The tactile sense; the ability to feel objects and to distinguish their various physical characteristics; the ability to perceive pressure when it is exerted on the skin

OBJECTIVE 4

a. A craving or urgent need for food

b. A perceived desire for water or fluid

c. The sense of balance; the awareness of body position and changes in body position

d. The sensation pertaining to stimuli originating from within the body regarding spatial position

OBJECTIVE 5

a. The dense, fibrous, opaque, white outer coating that encloses and protects the inner eye

b. The thin, highly vascular middle membrane containing large branched pigmented cells; this layer provides the blood supply for the entire eye, and the pigmented cells prevent extraneous light from entering the inside of the eye

OBJECTIVE 5 (CONT.)

c. The 10-layered, delicate nervous-tissue membrane of the eye that is continuous with the optic nerve, receives images of external objects, and transmits visual impulses through the optic nerve to the brain

d. The cavity of the eye in front of the iris; the cavity that contains the aqueous humor

e. The cavity in the eye posterior to the crystalline lens; the cavity that contains the vitreous humor

OBJECTIVE 6

a. eyeball; orbit
b. voluntary; focus vision
c. body
d. involuntary; the amount of light

OBJECTIVE 7

a. The mucous membrane that lines the inner surfaces of the eyelids and continues over the anterior part of the sclera

b. The transparent part of the sclera that passes in front of the crystalline lens and allows light to enter the inner eye

c. The transparent structure of the eye that is enclosed in a capsule situated between the iris and the vitreous humor; it refracts light to focus images on the retina

d. The ringlike, fibrous membrane that connects the ciliary muscle and the crystalline lens of the eye and holds the lens in place

e. The pigmented part of the choroid layer that produces the eye color and functions as a sphincter

f. The semitransparent, circular band of smooth muscle fibers attached to the choroid coat of the eye; the chief agent in adjusting the eye to view near objects

g. Either of the pair of nerves that comprise the second pair of cranial nerves, supply the retina, and conduct visual stimuli to the brain

OBJECTIVE 8

a. Conjunctiva
b. Iris
c. Anterior cavity (aqueous humor)
d. Cornea
e. Suspensory ligament
f. Ciliary muscle
g. Crystalline lens
h. Sclera
i. Choroid coat
j. Retina
k. Optic nerve
l. Vitreous cavity (vitreous humor)

Objective 9

a. sphincter
b. vitreous humor; crystalline lens; aqueous humor
c. retina
d. Rods
e. Cones
f. optic nerve
g. optic nerve; vision

Objective 10

a. The arch of hairs growing along the ridge formed by the supraorbital arch of the frontal bone

b. One of many cilia growing in triple rows along the border of the eyelids

c. A movable fold of thin skin over the eye, consisting of loose connective tissue containing a thin plate of fibrous tissue lined with mucous membrane

d. One of a pair of small, almond-shaped glands located in the upper, outer portion of each orbit, which secretes tears that keep the anterior surface of the eye moist and free from irritating particles

e. One of about 10 ducts that run beneath a lacrimal gland to pass tears through the conjunctiva

f. One of two ducts in each eye that is located at the inner edge of the eye and allows tears to leave the eye and wash into the lacrimal sac

g. The large, rounded, closed end of the nasolacrimal duct

h. The duct that extends into the nasal cavity

Objective 11

a. 6
b. 7
c. 4
d. 2
e. 8
f. 10
g. 3
h. 5
i. 1
j. 9

Objective 12

a. The outer portion of the ear that consists of the auricle and the portion of the external auditory canal that is outside the skull

b. The central portion of the ear consisting of the tympanic cavity and the auditory ossicles contained in an irregular space in the temporal bone; it is separated from the external ear by the tympanic membrane and from the inner ear by the oval window

c. The complex inner structure of the ear that contains the receptors that help maintain equilibrium and that translate sound vibrations into impulses for the sense of hearing

Objective 13

a. Sound waves are scooped up by the auricle and travel on the air in the external auditory canal to the tympanic membrane

b. Sound waves are changed to sound vibrations at the tympanic membrane, and the vibrations are conducted through the middle ear by the three bones—the malleus, incus, and stapes

c. Sound vibrations are carried by the fluid in the cochlea of the inner ear, which contains the hearing receptors that convert the vibrations to nerve impulses

Objective 14

a. The skin-covered cartilaginous portion of the external ear that is visible on either side of the head; the structure collects sound waves traveling through the air and channels them to the external auditory canal

b. The slender, tubelike passageway of the external ear that is lined with ceruminous glands; the structure funnels sound waves from the external ear to the structures of the middle ear

c. The thin membrane located at the end of the external auditory canal that marks the beginning of the middle ear and functions to transmit sound vibrations to the inner ear by means of the ossicles; also called the *eardrum*

d. The hammer-shaped ossicle of the middle ear that is attached to the tympanic membrane and transfers sound vibrations from the tympanic membrane to the incus

e. The anvil-shaped ossicle of the middle ear that is attached to the malleus and transfers sound vibrations to the stapes

f. The stirrup-shaped ossicle of the middle ear that is attached to the incus and transfers sound vibrations to the inner ear

g. An oval-shaped, membrane-covered opening on the external surface of the cochlea that is connected to the stapes

h. The snail-shaped structure of the inner ear that is filled with fluid; sound vibrations transferred from the stapes cause the stapes to bump against the oval window; the stimulation of the oval window then causes the fluid in the cochlea to move

i. A spiral structure within the cochlea that contains hair cells (hairs of Corti) that are stimulated by sound vibrations; the hair cells convert the vibrations into nerve impulses that are transmitted by the acoustic nerve (cranial nerve VIII) to the brain

j. The bony and cartilaginous tube that connects the middle ear to the nasal passages in order to equalize the air pressure in the middle ear with atmospheric pressure and produce proper vibrations

Objective 15

a. The central portion of the inner ear that joins the cochlea and the semicircular canals and assists with the sensations of position and movement

b. The three bony, fluid-filled loops of the inner ear that open into the cochlea and contain the receptors for equilibrium

Objective 16

a. Serves as the pathway to the brain for the transport of nerve impulses for sound

b. Serves as the pathway to the brain for the transport of the nerve impulses for balance/equilibrium

Objective 17

a. Auricle
b. Malleus
c. Incus
d. Stapes
e. Semicircular canals
f. Oval window
g. Acoustic nerve
h. Cochlea
i. Vestibule
j. Eustachian tube
k. Tympanic membrane
l. External auditory canal

Objective 18

a. An inherited bone disorder that causes a deformity of the stapes that causes tinnitus and then deafness

b. An inflammation or infection of the external auditory canal or the auricle usually caused by allergy, bacteria, fungi, viruses, or trauma

c. An inflammation or infection of the middle ear that is common during childhood; is usually caused by bacteria, virus, or allergy; and is often preceded by an upper-respiratory infection

d. A loss of hearing sensitivity and speech intelligibility that is associated with aging

e. A condition with an unknown cause that is characterized by vertigo, progressive hearing loss, tinnitus, and a sensation of pressure within the ear

f. A buildup of hardened cerumen that can interfere with the normal functioning of the ear

Objective 19

a. superior turbinate
b. olfactory bulb; olfactory tract

Objective 20

a. A loss or impairment of the sense of smell
b. An abnormally increased sensitivity to odor

Objective 21

a. taste buds
b. near the tip
c. along each side
d. near the back
e. VII; IX

Objective 22

A loss or impairment of the sense of taste

Objective 23

a. Superior turbinate
b. Middle turbinate
c. Inferior turbinate
d. Nasal cavity
e. Mouth cavity
f. Tongue
g. Olfactory membrane
h. Olfactory bulb

Objective 24

a. sensory dendrites
b. texture; pressure
c. temperature; temperature
d. Nociceptors
e. somatic; visceral; referred
f. Somatic
g. Visceral
h. Referred

Objective 25

a. Intermittent attacks to the extremities of the body—especially the fingers, toes, ears, and nose—that are characterized by numbness, tingling, burning, and often pain

b. A condition caused by compression of the median nerve where it passes through the wrist into the hand, leading to a sensation of tingling, numbness, or severe pain in the wrist and hand

c. A condition caused by compression of the nerves and blood vessels between the neck and shoulders

Answers to Assignment Sheet

Assignment Sheet 1

✔ **NOTE:** Case-study presentation must be evaluated to the satisfaction of the instructor; however, the following are suggested answers the instructor may use for the individual case studies.

CASE STUDY 1

The light receptors in the eye consist of rods and cones. Cones perform best in bright light and provide color vision and sharp focus. Rods respond well even in low light levels. The cones are concentrated on the back of the retina (fovea), while the rods are scattered more along the periphery of the retina. When a person looks directly at an object in low light levels, the light falls on the cones at the back of the retina, where the less-sensitive cones are unable to process the light well. By looking slightly to the side of the object (the star, in this case), light falls on the rods rather than the cones, and the sensory response is greater.

CASE STUDY 2

The point at which the optic-nerve bundle exits the retina to connect to the brain does not have receptor cells and, therefore, is not sensitive to light. It is referred to as the *blind spot.* When the light from the circle falls on the blind spot, it is not "seen" but reappears when the reflected light is no longer focused on the blind spot.

CASE STUDY 3

Equilibrium is determined by the position of otoliths, small "stones" in the ear. Movement of the head causes the otoliths to contact cilia in the ear, and it is this stimulation of the cilia that allows the brain to form an impression of the body's position. If the movement is rapid and continued, as in spinning around quickly, the pressure builds up against the cilia, giving the impression that the motion is continuing. The body reacts to this sensation of motion. With the eyes open, visual signals to the brain help to re-establish orientation.

CASE STUDY 4

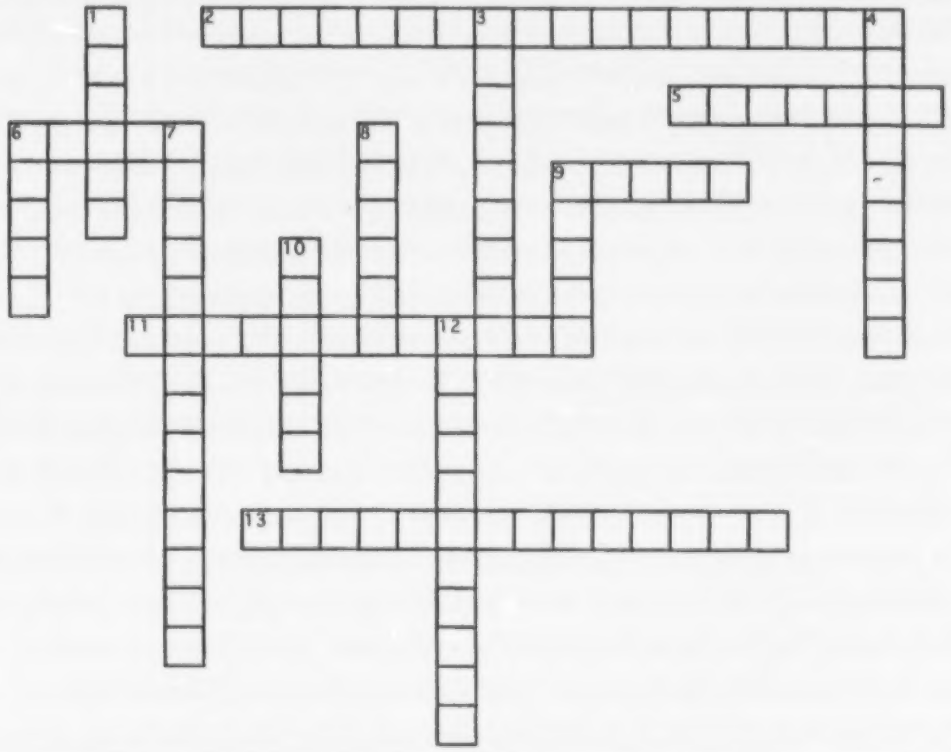
This case study gives the students lots of room to explore a number of issues related to aging and the senses. Many valid reasons may be offered. One of the more important is that, with the loss of the ability to smell, food has less flavor, which means that an elderly person may lose his or her desire to eat foods that were once favorites. Related to this is that some elderly persons compensate for the loss of taste by eating foods with intense flavors such as sugary sweets while avoiding more bland foods such as vegetables and grain products. Other answers that students may offer is that declining sight makes it harder to eat because a person does not sense the visual appeal that is important to eliciting our hunger response. Similarly, much of the eating that we do is for social interaction. The elderly often feel socially isolated, partially due to the loss of hearing and the difficulties in having normal conversations. Even the sense of hunger, as generated by the hypothalamus, may be less acute in the elderly.

CASE STUDY 5

Special sense organs are tools that the brain has to learn to use. Just as one learns to recognize the scent of vanilla, the taste of chocolate, the sound of a violin, or the feel of silk, the brain learns to associate stimulation of certain nerve endings with their location in the body. After an amputation, the nerve pathways are severed but are still capable of carrying signals to the brain. Pain experienced in the exposed ends of the nerve pathways is transmitted to the brain. For example, assume that a person whose arm has been amputated at the elbow experiences stimulation of the severed end of the median nerve, which serves the receptors in the fingers. The brain receives these signals. Having learned through years of living that the receptors for that nerve are in the fingers, the brain associates the pain with the fingers that are no longer there. The proprioceptive abilities of the brain tell it where the fingers should be based on the position of the upper arm, and the brain places the location of the pain in the space occupied by the imagined fingers.

Crossword Puzzle 1—Terms from Objectives 1 Through 4

Name _____ Date _____



ACROSS

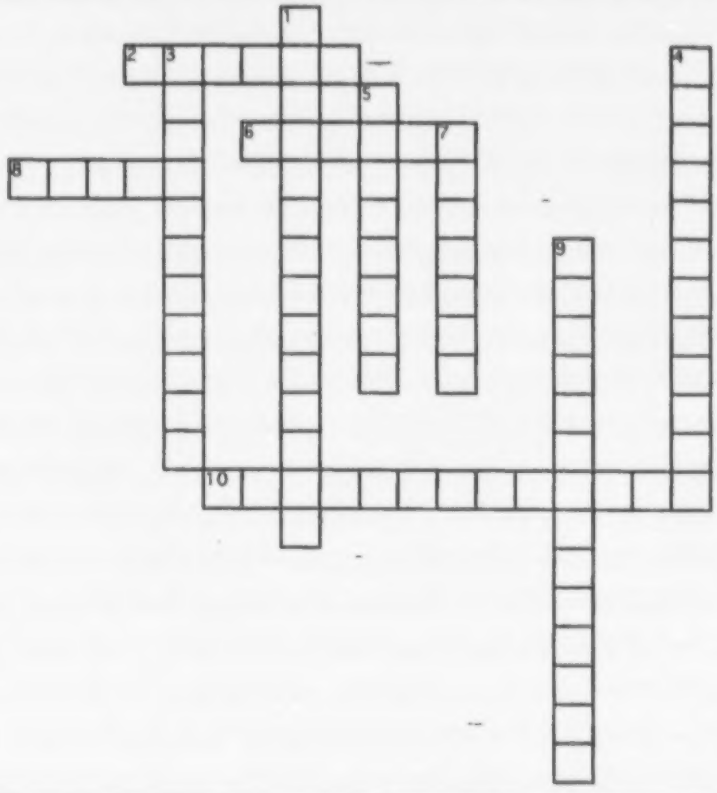
2. Specialized nerve cells that react to different types of stimuli (3 words)
5. The auditory sense; the special sense that enables sound to be perceived; the major function of the ear
6. The visual sense; the special sense that enables the shape, size, position, and color of objects to be perceived; the principal function of the eye
9. The tactile sense; the ability to feel objects and to distinguish their various physical characteristics; the ability to perceive pressure when it is exerted on the skin
11. The sense of sight, smell, taste, touch, or hearing (2 words)
13. The sensation pertaining to stimuli originating from within the body regarding spatial position

DOWN

1. A craving or urgent need for food
3. Stage 1 in a sensory response in which the receptor nerve cells in a receptor organ detect a stimulus and generate a sensory impulse
4. Stage 3 in a sensory response in which the appropriate sensory center in the brain receives the sensory impulse and interprets the impulse as a sensation
6. The olfactory sense; the special sense that enables odors to be perceived through the stimulation of the olfactory nerves; the principal function of the nose
7. Stage 2 in a sensory response in which the neural network carries the sensory impulse from the receptor to the brain
8. Relating to a nerve or the nervous system
9. The gustatory sense; the special sense of perceiving different flavors—sweet, salty, sour, and bitter—in soluble substances that contact the tongue and trigger nerve impulses to special taste centers in the cortex and the thalamus of the brain
10. A perceived desire for water or fluid
12. The sense of balance; the awareness of body position and changes in body position

Crossword Puzzle 2—Terms from Objective 5

Name _____ Date _____



ACROSS

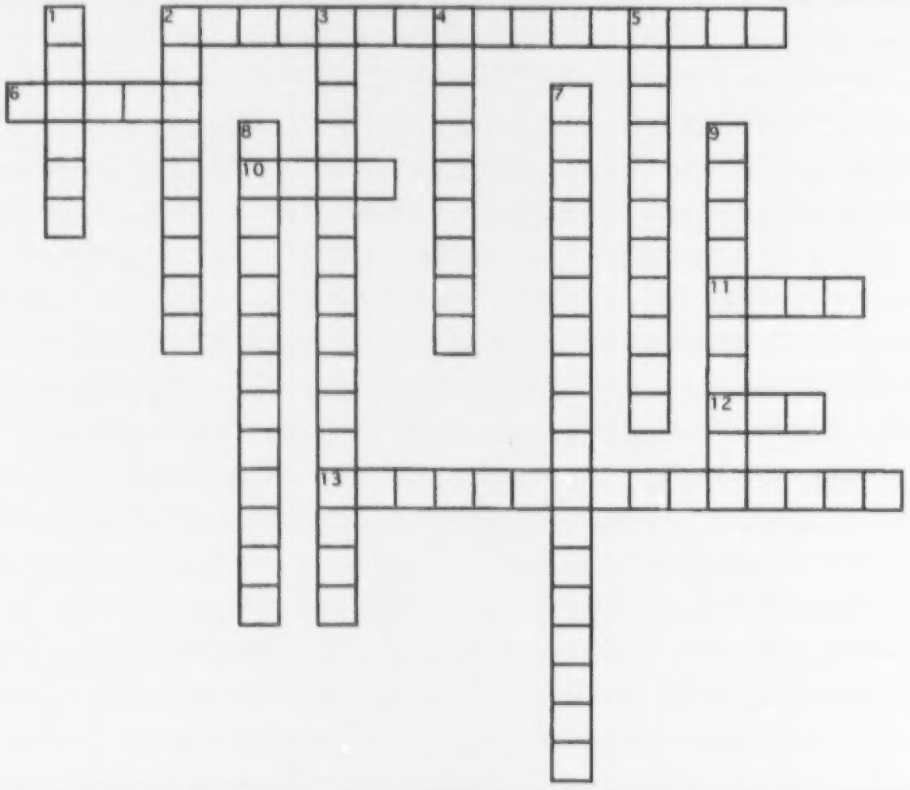
2. The dense, fibrous, opaque, white outer coating that encloses and protects the inner eye; the "white of the eye"
6. The 10-layered, delicate nervous-tissue membrane of the eye that is continuous with the optic nerve, receives images of external objects, and transmits visual impulses through the optic nerve to the brain
8. A body fluid
10. The clear, colorless, transparent, jelly-like fluid that fills the vitreous cavity of the eye (2 words)

DOWN

1. The cavity of the eye in front of the iris; the cavity that contains the aqueous humor (2 words)
3. The thin, highly vascular middle membrane containing large branched pigmented cells; this layer provides the blood supply for the entire eye, and the pigmented cells prevent extraneous light from entering the inside of the eye (2 words)
4. The watery, transparent fluid occupying the anterior cavity of the eye; it provides nourishment for the crystalline lens and the cornea (2 words)
5. Resembling glass
7. Of, relating to, or resembling water
9. The cavity in the eye posterior to the crystalline lens; the cavity that contains the vitreous humor (2 words)

Crossword Puzzle 3—Terms from Objectives 6 Through 9

Name _____ Date _____



ACROSS

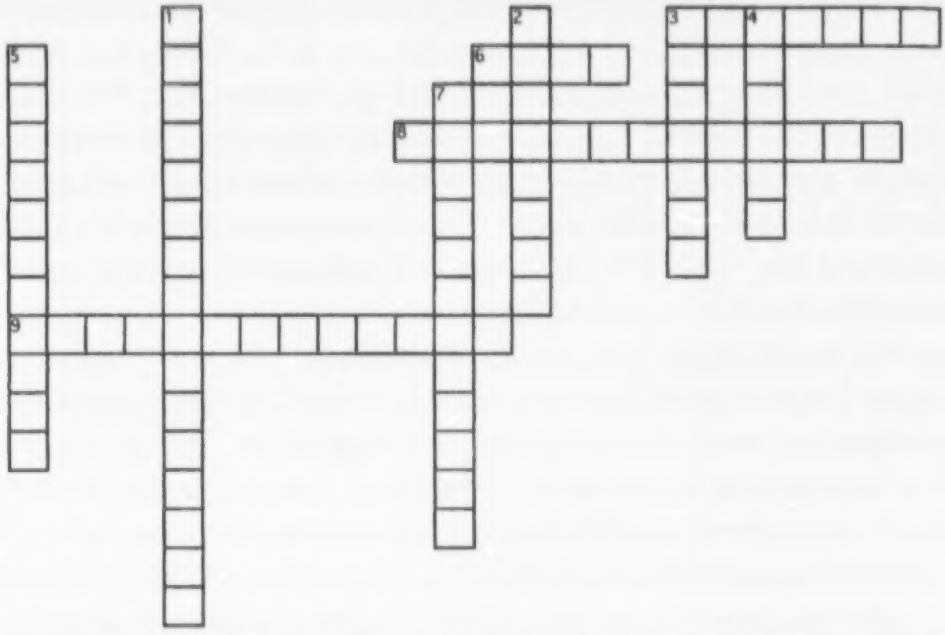
2. The muscles of the eye that are attached to the outside of the eyeball and to the bones of the orbit; the voluntary muscles that move the eyeballs and coordinate the muscles of the separate eyes in order to focus vision (2 words)
6. One of a pair of bony, conical cavities in the skull that accommodate the eyeballs and associated structures
10. The pigmented part of the choroid layer that produces the eye color and functions as a sphincter
11. The type of visual receptor that functions in bright light and produces color vision
12. The type of visual receptor that functions in dim light and produces black-and-white vision
13. The transparent structure of the eye that is enclosed in a capsule situated between the iris and the vitreous humor; it refracts light to focus images on the retina (2 words)

DOWN

1. The transparent part of the sclera that passes in front of the crystalline lens and allows light to enter the inner eye
2. Originating outside a part and acting upon the part as a whole
3. The muscles of the eye that are located within the body of the eye; these muscles consist of two involuntary muscles: the iris and the ciliary muscle, which adjust the amount of light entering the eye and allow the eyes to focus on objects at varying distances (2 words)
4. Originating and including wholly within an organ or part
5. The mucous membrane that lines the inner surfaces of the eyelids and continues over the anterior part of the sclera
7. The ringlike, fibrous membrane that connects the ciliary muscle and the crystalline lens of the eye and holds the lens in place (2 words)
8. The semitransparent, circular band of smooth muscle fibers attached to the choroid coat of the eye; the chief agent in adjusting the eye to view near objects (2 words)
9. Either of the pair of nerves that comprise the second pair of cranial nerves, supply the retina, and conduct visual stimuli to the brain (2 words)

Crossword Puzzle 4—Terms from Objective 10

Name _____ Date _____



ACROSS

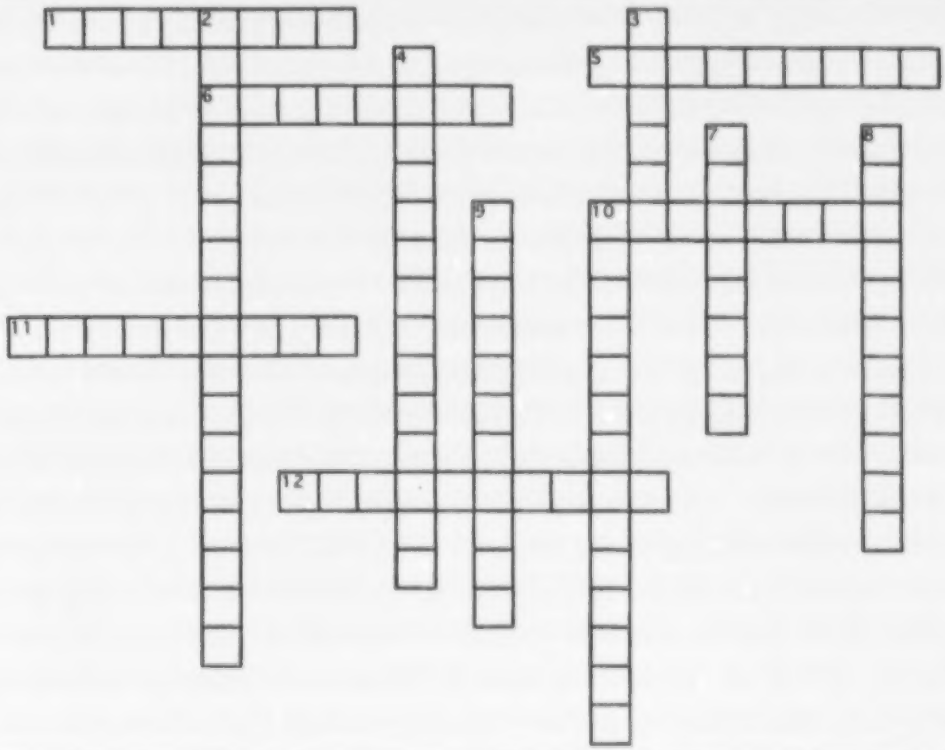
3. The arch of hairs growing along the ridge formed by the supraorbital arch of the frontal bone
6. Pertaining to the nose
8. One of a pair of small, almond-shaped glands located in the upper, outer portion of each orbit, which secretes tears that keep the anterior surface of the eye moist and free from irritating particles (2 words)
9. One of two ducts in each eye that is located at the inner edge of the eye and allows tears to leave the eye and wash into the lacrimal sac (2 words)

DOWN

1. The duct that extends into the nasal cavity (2 words)
2. Of or pertaining to tears
3. One of many cilia growing in triple rows along the border of the eyelids
4. A movable fold of thin skin over the eye, consisting of loose connective tissue containing a thin plate of fibrous tissue lined with mucous membrane
5. The large, rounded, closed end of the nasolacrimal duct (2 words)
7. One of about 10 ducts that run beneath a lacrimal gland to pass tears through the conjunctiva (2 words)

Crossword Puzzle 5—Terms from Objectives 11 and 12

Name _____ Date _____



ACROSS

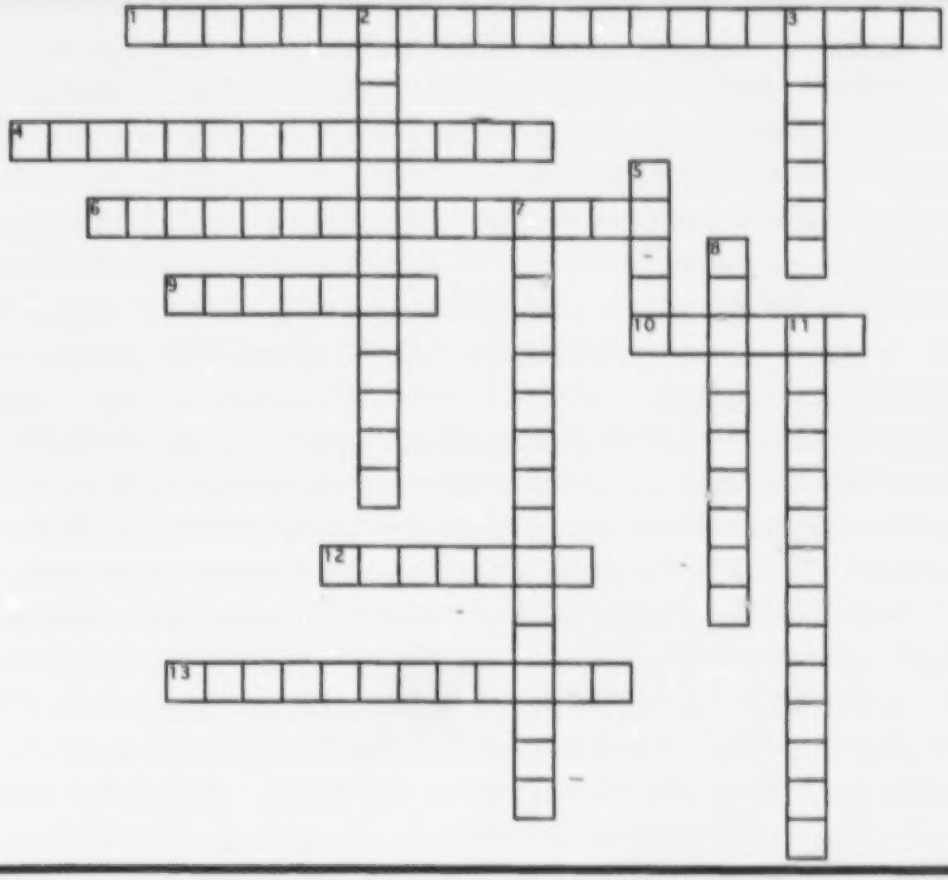
1. The complex inner structure of the ear that contains the receptors that help maintain equilibrium and that translate sound vibrations into impulses for the sense of hearing (2 words)
5. Farsightedness, a condition caused by the shortening of the eyeball or by an error in refraction so that the light rays entering the eye are focused behind the retina
6. A chronic, contagious bacterial conjunctivitis characterized by inflammatory granulations that, if left untreated, form follicles on the upper eyelids and grow larger until the granulations invade the cornea, eventually causing blindness
10. An abnormal, progressive condition of the crystalline lens of the eye that is characterized by the loss of transparency
11. The central portion of the ear consisting of the tympanic cavity and the auditory ossicles contained in an irregular space in the temporal bone; it is separated from the external ear by the tympanic membrane and from the inner ear by the oval window (2 words)
12. Night blindness; poor vision at night or in dim light

DOWN

2. A separation of the retina from the choroid in the back of the eye, usually resulting from a hole in the retina that allows the vitreous humor to leak between the choroid and the retina (2 words)
3. Nearsightedness, a condition caused by the elongation of the eyeball or by an error in refraction so that the light rays entering the eye are focused in front of the retina
4. An inflammation of the conjunctiva caused by bacterial or viral infection, allergy, or environmental factors and characterized by red eyes, a thick discharge, sticky eyelids in the morning, and inflammation without pain
7. An abnormal condition of elevated pressure within an eye that is caused by the obstruction of the outflow of aqueous humor
8. A condition caused by abnormal curvature of the cornea or crystalline lens so that light rays cannot be focused clearly in a point on the retina
9. The outer portion of the ear that consists of the auricle and the portion of the external auditory canal that is outside the skull (2 words)
10. An abnormal condition characterized by an inability to clearly distinguish the colors of the spectrum (2 words)

Crossword Puzzle 6—Terms from Objectives 13 and 14

Name _____ Date _____



ACROSS

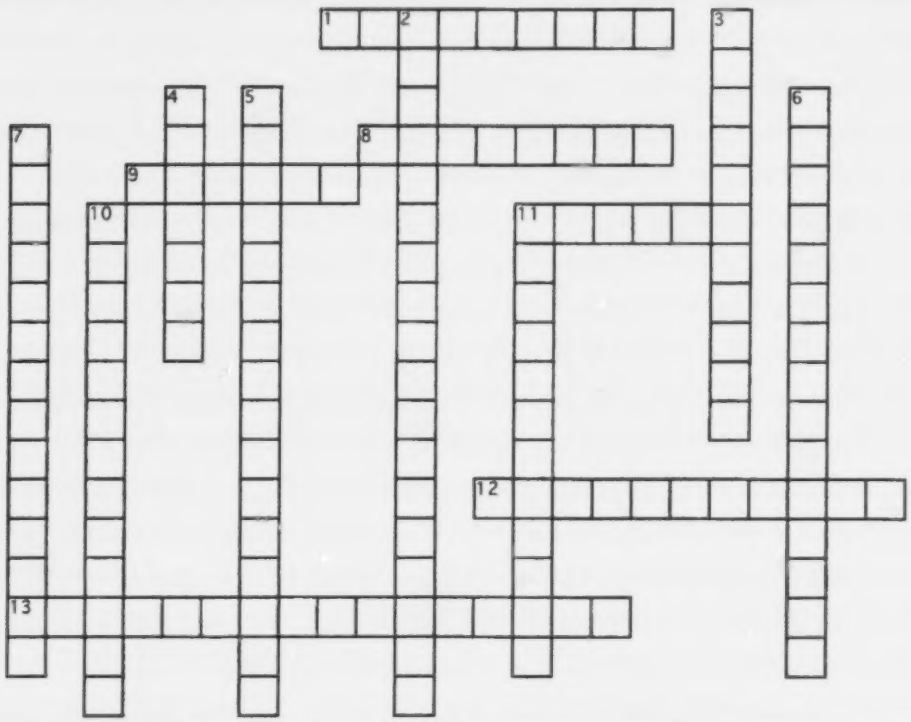
1. The slender, tubelike passageway of the external ear that is lined with ceruminous glands; the structure funnels sound waves from the external ear to the structures of the middle ear (3 words)
4. Type of sound conduction within the ear in which sound waves are changed to sound vibrations at the tympanic membrane, and the vibrations are conducted through the middle ear by the three bones—the malleus, incus, and stapes (2 words)
6. Type of sound conduction within the ear in which sound vibrations are carried by the fluid in the cochlea of the inner ear, which contains the hearing receptors that convert the vibrations to nerve impulses (2 words)
9. The hammer-shaped ossicle of the middle ear that is attached to the tympanic membrane and transfers sound vibrations from the tympanic membrane to the incus
10. The stirrup-shaped ossicle of the middle ear that is attached to the incus and transfers sound vibrations to the inner ear
12. The snail-shaped structure of the inner ear that is filled with fluid; sound vibrations transferred from the stapes cause the stapes to bump against the oval window; the stimulation of the oval window then causes the fluid in this structure to move
13. A spiral structure within the cochlea that contains hair cells (hairs of Corti) that are stimulated by sound vibrations; the hair cells convert the vibrations into nerve impulses that are transmitted by the acoustic nerve (cranial nerve VIII) to the brain (3 words)

DOWN

2. Type of sound conduction within the ear in which sound waves are scooped up by the auricle and travel on the air in the external auditory canal to the tympanic membrane (2 words)
3. The skin-covered cartilaginous portion of the external ear that is visible on either side of the head; the structure collects sound waves traveling through the air and channels them to the external auditory canal
5. The anvil-shaped ossicle of the middle ear that is attached to the malleus and transfers sound vibrations to the stapes
7. The thin membrane located at the end of the external auditory canal that marks the beginning of the middle ear and functions to transmit sound vibrations to the inner ear by means of the ossicles; also called the *eardrum* (2 words)
8. An oval-shaped, membrane-covered opening on the external surface of the cochlea that is connected to the stapes (2 words)
11. The bony and cartilaginous tube that connects the middle ear to the nasal passages in order to equalize the air pressure in the middle ear with atmospheric pressure and produce proper vibrations (2 words)

Crossword Puzzle 7—Terms from Objectives 15 Through 18

Name _____ Date _____



ACROSS

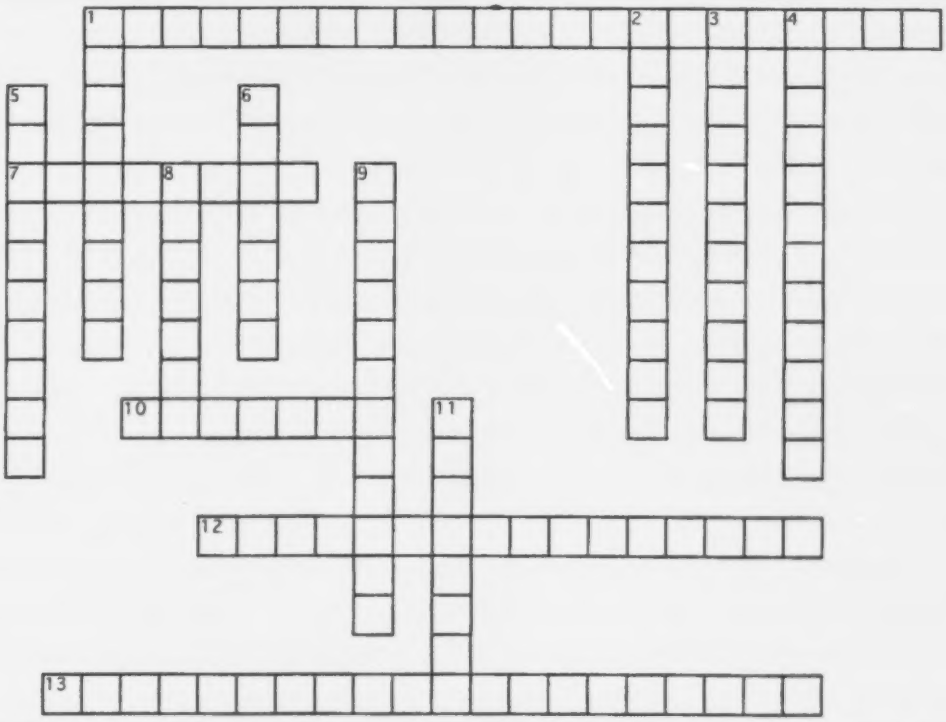
1. The central portion of the inner ear that joins the cochlea and the semicircular canals and assists with the sensations of position and movement
8. A sensation of ringing in the ear
9. A combining form meaning "pertaining to aging or being elderly"
11. An inflammation or infection of the ear
12. A loss of hearing sensitivity and speech intelligibility that is associated with aging
13. A buildup of hardened cerumen that can interfere with the normal functioning of the ear (2 words)

DOWN

2. The three bony, fluid-filled loops of the inner ear that open into the cochlea and contain the receptors for equilibrium (2 words)
3. An inflammation or infection of the middle ear that is common during childhood; is usually caused by bacteria, virus, or allergy; and is often preceded by an upper-respiratory infection (2 words)
4. A sensation of the entire body spinning that is often caused by impairment of the equilibrium mechanism
5. The branch of the acoustic nerve that serves as the pathway to the brain for the transport of the nerve impulses for balance/equilibrium (2 words)
6. A condition with an unknown cause that is characterized by vertigo, progressive hearing loss, tinnitus, and a sensation of pressure within the ear (2 words)
7. The branch of the acoustic nerve that serves as the pathway to the brain for the transport of nerve impulses for sound (2 words)
10. An inflammation or infection of the external auditory canal or the auricle usually caused by allergy, bacteria, fungi, viruses, or trauma (2 words)
11. An inherited bone disorder that causes a deformity of the stapes that causes tinnitus and then deafness

Crossword Puzzle 8—Terms from Objectives 19 Through 25

Name _____ Date _____



ACROSS

1. A condition caused by compression of the nerves and blood vessels between the neck and shoulders (3 words)
7. Folded lengthwise like a fan
10. Any of the small projections on the upper surface of the tongue
12. Intermittent attacks to the extremities of the body—especially the fingers, toes, ears, and nose—that are characterized by numbness, tingling, burning, and often pain (2 words)
13. A condition caused by compression of the median nerve where it passes through the wrist into the hand, leading to a sensation of tingling, numbness, or severe pain in the wrist and hand (3 words)

DOWN

1. One of several thin, plicated membrane-covered bony or cartilaginous plates on the walls of the nasal cavity
2. Pain that is sensed in the skin and can be superficial or deep (2 words)
3. Sensory receptors located in the skin and viscera that sense pain to provide a warning of potentially harmful conditions
4. Pain that exists in an internal organ or deep structure but is felt in another region (2 words)
5. An abnormally increased sensitivity to odor
6. A loss or impairment of the sense of taste
8. A loss or impairment of the sense of smell
9. Pain that is sensed in the internal organs (2 words)
11. A set of symptoms that together characterize an abnormal condition

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
2. RECEPTOR NERVE CELLS
5. HEARING
6. SIGHT
9. TOUCH
11. SPECIAL SENSE
13. PROPRIOCEPTION

DOWN
1. HUNGER
3. RECEPTION
4. SENSATION
6. SMELL
7. TRANSPORTATION
8. NEURAL
9. TASTE
10. THIRST
12. EQUILIBRIUM

Crossword Puzzle 2

ACROSS
2. SCLERA
6. RETINA
8. HUMOR
10. VITREOUS HUMOR

DOWN
1. ARTERIOR CAVITY
3. CHOROID COAT
4. AQUEOUS HUMOR
7. AQUEOUS
9. VITREOUS CAVITY

Crossword Puzzle 3

ACROSS
2. EXTRINSIC MUSCLES
6. ORBIT
10. IRIS
11. CONE
12. ROD
13. CRYSTALLINE LENS

DOWN
1. CORNEA
2. EXTRINSIC
3. INTRINSIC MUSCLES
4. INTRINSIC
5. CONJUNCTIVA
7. SUSPENSORY LIGAMENT
8. CILIARY MUSCLE
9. OPTIC NERVE

Crossword Puzzle 4

ACROSS
3. EYEBROW
6. NASO
8. LACRIMAL GLAND
9. LACRIMAL CANAL

DOWN
1. NASOLACRIMAL DUCT
2. LACRIMAL
3. EYELASH
4. EYELID
5. LACRIMAL SAC
7. LACRIMAL DUCT

Crossword Puzzle 5

ACROSS
1. INNER EAR
5. HYPEROPIA
6. TRACHOMA
10. CATARACT
11. MIDDLE EAR
12. NYCTALOPIA

DOWN
2. RETINAL DETACHMENT
3. MYOPIA
4. CONJUNCTIVITIS
7. GLAUCOMA
8. ASTIGMATISM
9. EXTERNAL EAR
10. COLOR BLINDNESS

Crossword Puzzle 6

ACROSS
1. EXTERNAL AUDITORY CANAL
4. BONE CONDUCTION
6. FLUID CONDUCTION
9. MALLEUS
10. STAPES
12. COCHLEA
13. ORGAN OF CORTI

DOWN
2. AIR CONDUCTION
3. AURICLE
5. INCUS
7. TYMPANIC MEMBRANE
8. OVAL WINDOW
11. EUSTACHIAN TUBE

Crossword Puzzle 7

ACROSS
1. VESTIBULE
8. TINNITUS
9. PRESBY
11. OTITIS
12. PRESBYCUSIS
13. CERUMEN IMPACTION

DOWN
2. SEMICIRCULAR CANALS
3. OTITIS MEDIA
4. VERTIGO
5. VESTIBULAR BRANCH
6. MENIERES DISEASE
7. COCHLEAR BRANCH
10. OTITIS EXTERNA
11. OTOSCLEROSIS

Crossword Puzzle 8

ACROSS
1. THORACIC OUTLET SYNDROME
7. PLICATED
10. PAPILLA
12. RAYNAUDS SYNDROME
13. CARPAL TUNNEL SYNDROME

DOWN
1. TURBINATE
2. SOMATIC PAIN
3. NOCICEPTORS
4. REFERRED PAIN
5. HYPEROSMIA
6. AGEUSIA
8. ANOSMIA
9. VISCERAL PAIN
11. SYNDROME

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 24

1. The sense of touch provides information about _____.

   a. texture and size

   b. size and distance

   c. distance and pressure

   d. texture and pressure

Objective 25

2. _____ is a condition characterized by tingling, numbness, or severe pain in the wrist and hand.

   a. Carpal-tunnel syndrome

   b. Raynaud's syndrome

   c. Thoracic-outlet syndrome

   d. Ageusia

Objective 2

3. A nerve cell that reacts to different types of stimuli is called a _____.

   a. *proprioceptor*

   b. *nerve pathway*

   c. *receptor cell*

   d. *sensory-center cell*

Objective 21

4. Which of the following is the correct correlation between taste receptors and their location on the tongue?

   a. Receptors for salty taste are localized near the tip of the tongue.

   b. Receptors for sour taste are localized near the tip of the tongue.

   c. Receptors for bitter taste are localized along the sides of the tongue.

   d. Receptors for sweet taste are localized near the back of the tongue.

Objective 11

5. The inability to see normally well in dim light is _____ blindness.

   a. color
   b. gray
   c. day
   d. night

Objective 3

6. The sense of touch is also called the _____ *sense.*

   a. *auditory*
   b. *olfactory*
   c. *gustatory*
   d. *tactile*

Objective 22

7. _____ is a loss of the sense of taste.

   a. Anosmia
   b. Hyperosmia
   c. Ageusia
   d. Hypogeusia

Objective 4

8. _____ is the sensation pertaining to stimuli originating from within the body regarding spatial position.

   a. Equilibrium
   b. Proprioception
   c. Fatigue
   d. Hunger

Objective 18

9. A buildup of hardened cerumen that can interfere with the normal functioning of the ear is known as _____.

   a. *dizziness*
   b. *deafness*
   c. *cerumen impaction*
   d. *cerumen retraction*

Objective 5

10. The _____ is the 10-layered nervous-tissue membrane of the eye that is continuous with the optic nerve.

    a. sclera

    b. choroid coat

    c. retina

    d. anterior cavity

Objective 12

11. The complex structure of the ear that contains the receptors that help maintain equilibrium is the _____.

    a. auricle

    b. inner ear

    c. middle ear

    d. auditory canal

Objective 5

12. A clear, jelly-like fluid in the posterior cavity of the eye is known as _____ *humor.*

    a. *aqueous*

    b. *vitreous*

    c. *anterior*

    d. *posterior*

Objective 10

13. The nasolacrimal duct _____.

    a. allows tears to leave the eye and wash into the lacrimal sac

    b. is the closed end of the lacrimal canal

    c. extends into the nasal cavity

    d. is one of 10 ducts that run beneath a lacrimal gland

Objective 24

14. _____ pain is pain that exists in an internal organ or deep structure but is felt in another region.

    a. Somatic

    b. Psychosomatic

    c. Referred

    d. Visceral

Objective 6

15. Of the muscles that control the eye, which of the following is an involuntary muscle?

    a. inferior

    b. ciliary

    c. medial

    d. lateral rectus

Objective 15

16. The three bony, fluid-filled loops of the inner ear that open into the cochlea and contain the receptors for equilibrium are the _____.

    a. auricles

    b. organs of Corti

    c. eustachian tubes

    d. semicircular canals

Objective 7

17. The _____ is the pigmented part of the choroid layer.

    a. conjunctiva

    b. cornea

    c. suspensory ligament

    d. iris

Objective 14

18. The eustachian tube connects the middle ear to the nasal passages in order to _____.

    a. equalize the air pressure in the middle ear with atmospheric pressure

    b. equalize the air pressure in the organ of Corti with middle-ear pressure

    c. drain ceruminous-gland secretions

    d. drain perilymph fluid

Objective 8

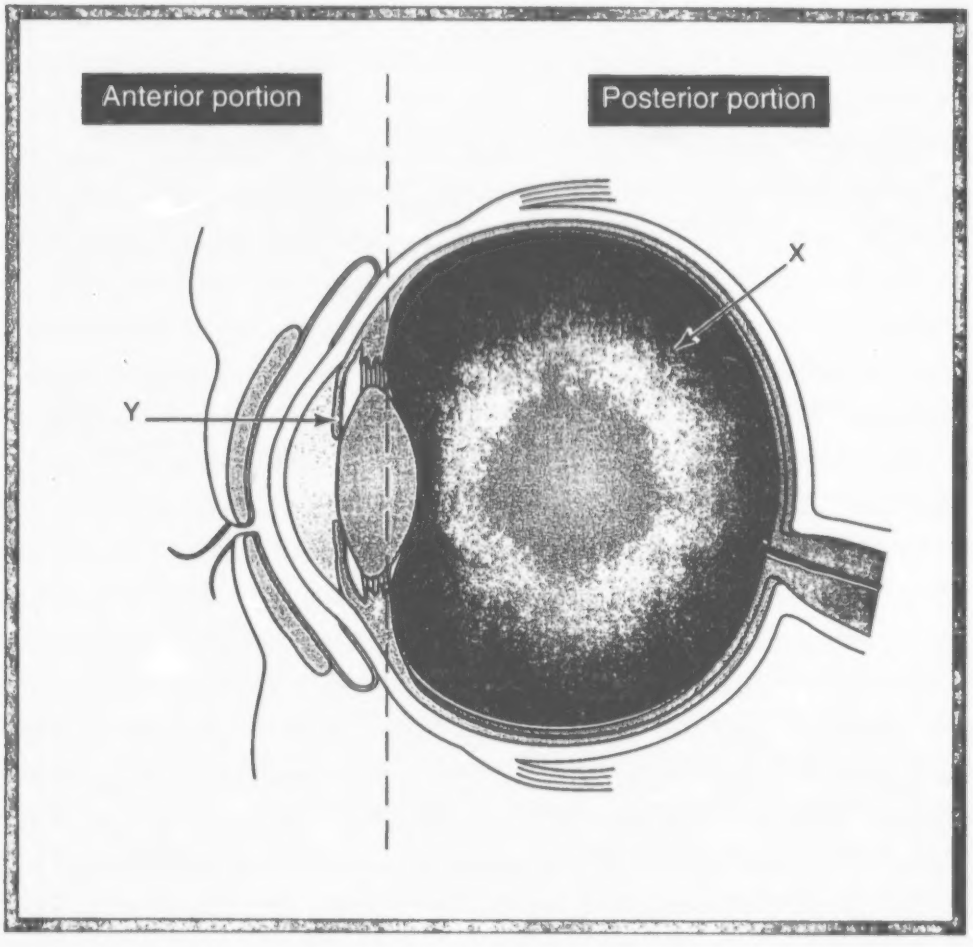
19. The structure indicated by the letter "X" in the illustration below is the _____.

a. anterior cavity

b. aqueous humor

c. vitreous cavity

d. optic nerve



Objective 8

20. The structure indicated by the letter "Y" in the illustration above is the _____.

a. sclera

b. iris

c. cornea

d. choroid coat

Objective 8

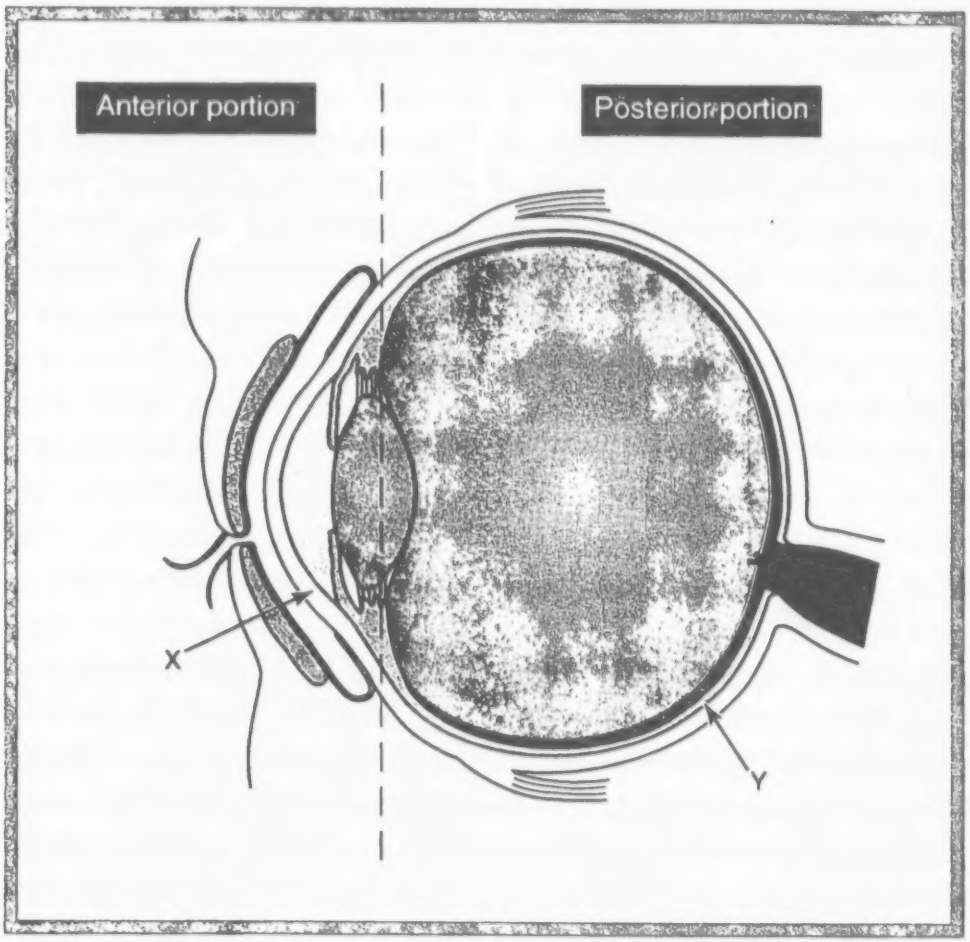
21. The structure indicated by the letter "X" in the illustration below is the _____.

a. sclera

b. iris

c. cornea

d. choroid coat



Objective 8

22. The structure indicated by the letter "Y" in the illustration above is the _____.

a. sclera

b. choroid coat

c. retina

d. iris

Objective 9

23. The _____ are the structures of the eye that bend light rays and focus them on the retina.

a. vitreous humor, rods, and cones

b. vitreous humor, iris, and optic nerve

c. vitreous humor, iris, and retina

d. vitreous humor, crystalline lens, and aqueous humor

Objective 18

24. A loss of hearing sensitivity and speech intelligibility associated with aging is _____.

a. presbycusis

b. otitis

c. tinnitus

d. vertigo

Objective 10

25. The lacrimal glands _____.

a. are lined with a mucous membrane called the *conjunctiva*

b. consist of voluntary muscles and skin

c. provide a continuous transparent covering over the surface of the eyeball

d. are located in the upper and outer portions of each orbit

Objective 5

26. The cavity of the eye in front of the iris is known as the _____ *cavity.*

a. *aqueous*

b. *vitreous*

c. *anterior*

d. *posterior*

Objective 11

27. An abnormal, progressive condition of the crystalline lens of the eye that is characterized by a loss of transparency is referred to as a _____.

a. *cataract*

b. *goiter*

c. *stigmatism*

d. *retinal detachment*

Objective 14

28. The oval-shaped, membrane-covered opening on the external surface of the cochlea is the _____.

    a. stapes
    b. organ of Corti
    c. tympanic membrane
    d. oval window

Objective 11

29. Glaucoma is _____.

    a. a condition of abnormal curvature of the cornea or lens
    b. an increased internal pressure within the eye that can lead to blindness
    c. conjunctivitis in newborns as a result of chlamydial bacteria in the mother's reproductive system
    d. an infection of the conjunctiva

Objective 3

30. The sense of _____ is also called the *olfactory sense*.

    a. sight
    b. hearing
    c. smell
    d. taste

Objective 5

31. Which of the layers of the eye contains the blood vessels of the eye as well as large, pigmented cells?

    a. retina
    b. choroid coat
    c. cornea
    d. ciliary layer

Objective 13

32. Sound waves travel in the external auditory canal by _____ conduction.

    a. fluid
    b. bone
    c. air
    d. tympanic

Objective 11

33. _____ is a condition in which the eye does not focus properly so that near objects can be seen well but not distant objects.

a. Nearsightedness

b. Farsightedness

c. Distant vision

d. Distant blindness

Objective 14

34. The external auditory canal is lined with _____.

a. cilia

b. otoliths

c. ossicles

d. ceruminous glands

Objective 18

35. _____ is an inflammation or infection of the ear.

a. Presbycusis

b. Otitis

c. Tinnitus

d. Vertigo

Objective 14

36. The external auditory canal is covered by the _____.

a. round window

b. oval window

c. tympanic membrane

d. temporal bone

Objective 7

37. The conjunctiva is _____.

a. a mucous membrane that passes in front of the crystalline lens

b. a mucous membrane that lines the inner surface of the eyelids

c. a mucous membrane that encloses a capsule between the iris and the vitreous humor

d. a mucous membrane that connects the ciliary muscle and the crystalline lens

Objective 14

38. The cochlea is filled with _____.

a. earwax

b. fluid

c. air

d. a vacuum

Objective 6

39. What is the purpose of the voluntary muscles of the eye?

a. to allow focusing of vision by the muscles of the separate eyes working in conjunction with each other

b. to adjust the amount of light entering the eye

c. to support the accessory structures of the eye

d. to cleanse the eyes and maintain adequate moisture in the eye sockets

Objective 19

40. The olfactory nerve is composed of fine filaments that are located _____.

a. in the mucous membrane of the inferior turbinate of the nasal cavity

b. in the mucous membrane of the superior turbinate of the nasal cavity

c. in the anterior portion of the brain

d. in the posterior portion of the brain

Objective 16

41. The vestibular portion of the acoustic nerve serves as a pathway for _____.

a. hearing

b. equilibrium

c. sight

d. pain

Objective 17

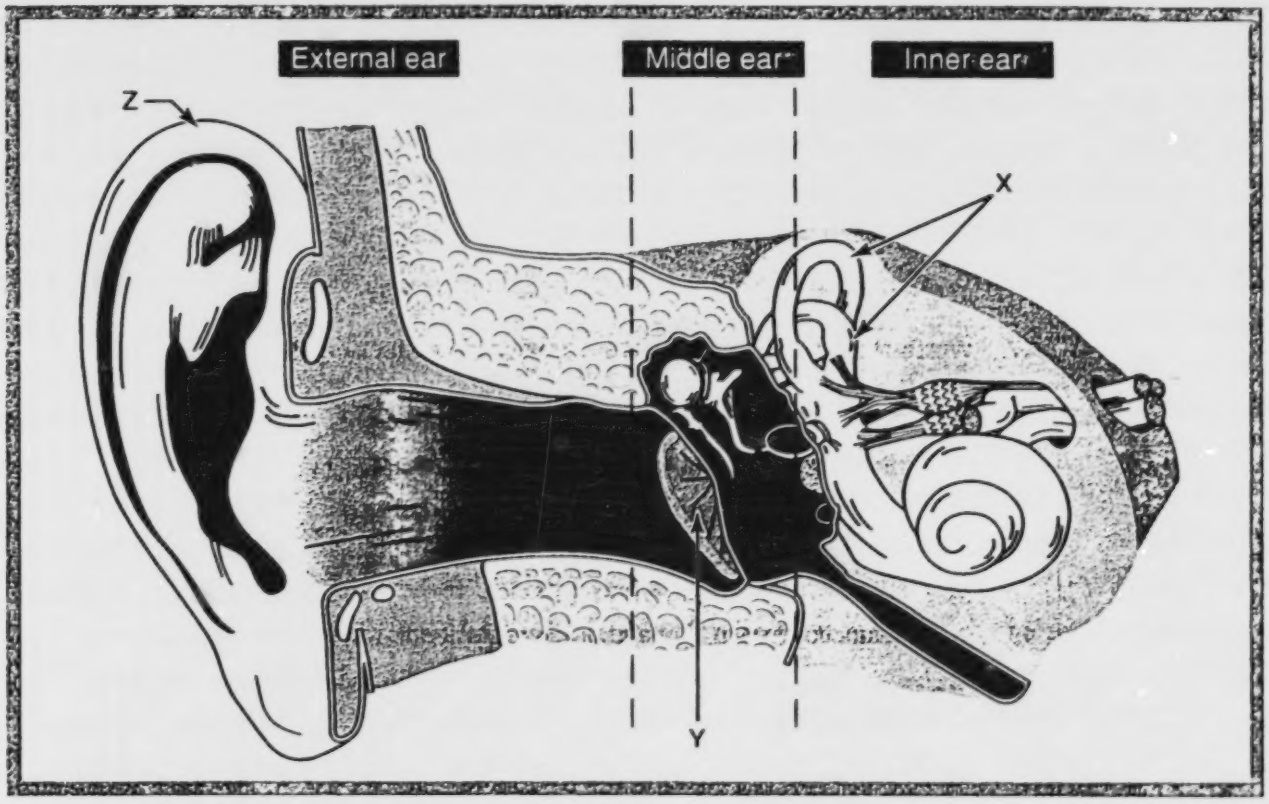
42. The structures indicated by the letter "X" in the illustration below are the _____.

a. auricles

b. semicircular canals

c. cochlea

d. tympanic membranes



Objective 17

43. The structure indicated by the letter "Y" in the illustration above is the _____.

a. auricle

b. semicircular canal

c. cochlea

d. tympanic membrane

Objective 17

44. The structure indicated by the letter "Z" in the illustration above is the _____.

a. auricle

b. semicircular canal

c. cochlea

d. tympanic membrane

Objective 18

45. _____ is an inherited bone disorder that causes deformity of the stapes.

a. Otitis

b. Mènière's disease

c. Presbycusis

d. Otosclerosis

Objective 5

46. The dense, fibrous, opaque outer coating of the eye that is commonly referred to as the *white of the eye* is the _____.

a. sclera

b. choroid coat

c. retina

d. anterior cavity

Objective 14

47. Which of the following is the correct sequence from external ear to inner ear?

a. malleus, incus, stapes

b. incus, stapes, malleus

c. stapes, malleus, incus

d. malleus, stapes, incus

Objective 9

48. _____ function in dim light and produce black-and-white vision.

a. Cones

b. Rods

c. Crystalline lenses

d. Sensory impulses

Objective 16

49. The cochlear portion of the acoustic nerve serves as a pathway for _____.

a. hearing

b. equilibrium

c. sight

d. pain

Objective 20

50. A reduced sense of smell is called _____.

    a. *anosmia*

    b. *hyperosmia*

    c. *ageusia*

    d. *hypogeusia*

Objective 3

51. Which of the following is a special sense organ that is associated with the sense of taste?

    a. eyes

    b. ears

    c. tongue

    d. lips

Objective 21

52. Taste receptors are connected to the _____.

    a. cranial nerves VI and VII

    b. cranial nerves VII and VIII

    c. cranial nerves VII and IX

    d. cranial nerves VIII and IX

Objective 4

53. The hypothalamus gland is associated with the sensations of _____.

    a. hunger and thirst

    b. equilibrium and proprioception

    c. sight and hearing

    d. fatigue and boredom

Objective 23

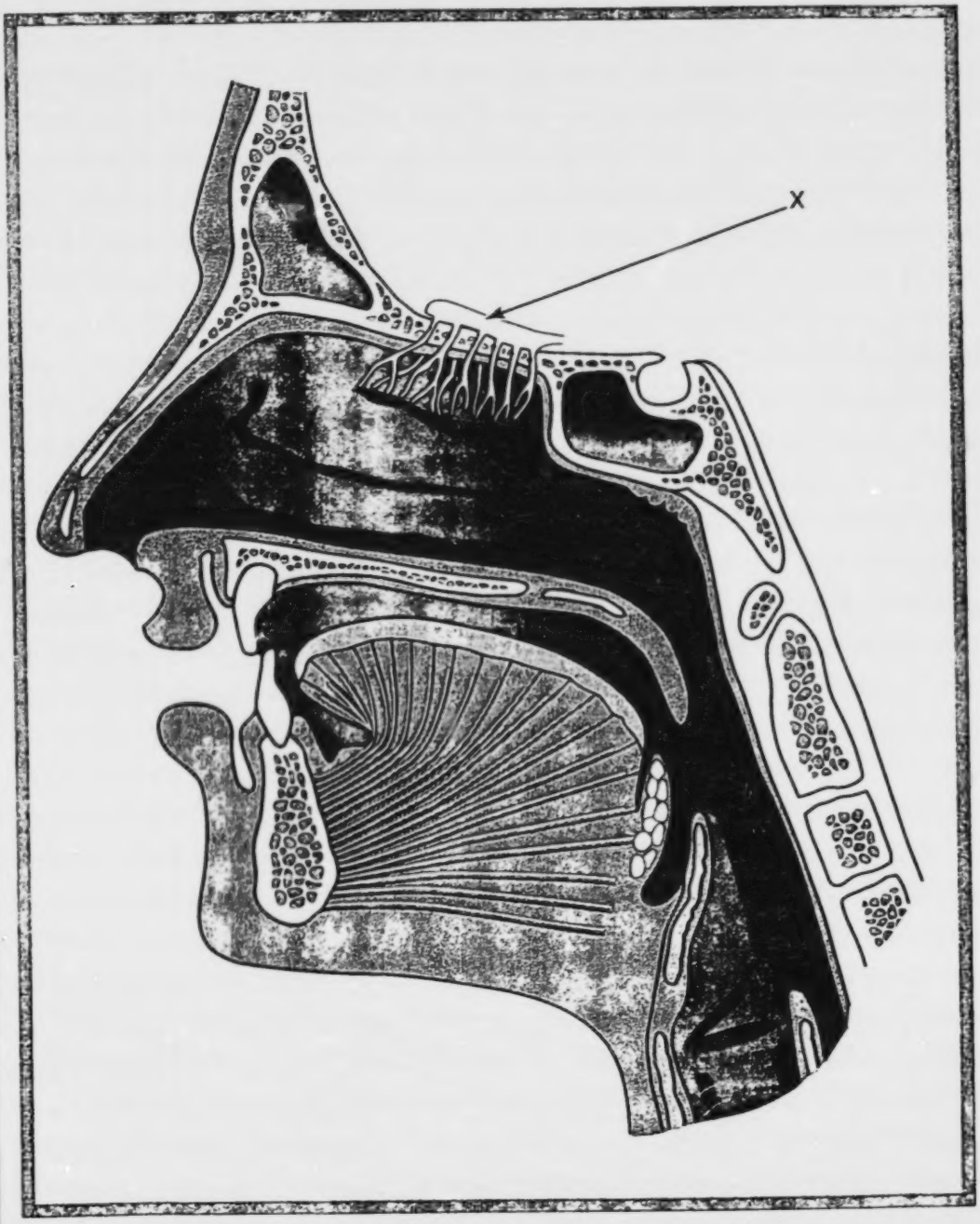
54. The structure indicated by the letter "X" in the illustration below is the _____.

a. olfactory bulb

b. olfactory membrane

c. superior turbinate

d. inferior turbinate



Objective 24

55. Touch is sensed by receptors of _____ located in the skin.

a. sensory dendrites

b. sensory synapses

c. sensory neurons

d. neural synapses

Objective 1

56. The special senses do NOT include which of the following?

a. sight

b. smell

c. taste

d. reception

Objective 24

57. _____ sense pain to provide warning of potentially harmful conditions.

a. Nociceptors

b. Visericeptors

c. Pariceptors

d. Sadoceptors

Objective 6

58. The muscles that attach to the outside of the eyeball and the bones of the orbit are referred to as _____.

a. *suspensory*

b. *ciliary*

c. *intrinsic*

d. *extrinsic*

Objective 25

59. _____ is a condition characterized by numbness, tingling, burning, and pain in the fingers, toes, ears, and nose.

a. Carpal-tunnel syndrome

b. Raynaud's syndrome

c. Thoracic-outlet syndrome

d. Ageusia

Objective 2

60. "The neural network carries the sensory impulse from the receptor to the brain" describes the _____ stage in a sensory response.

a. reception

b. transportation

c. sensation

d. interpretation

Answers to Module Review

1. d	13. c	25. d	37. b	49. a
2. a	14. c	26. c	38. b	50. a
3. c	15. b	27. a	39. a	51. c
4. a	16. d	28. d	40. b	52. c
5. d	17. d	29. b	41. b	53. a
6. d	18. a	30. c	42. b	54. a
7. c	19. c	31. b	43. d	55. a
8. b	20. b	32. c	44. a	56. d
9. c	21. c	33. a	45. d	57. a
10. c	22. b	34. d	46. a	58. d
11. b	23. d	35. b	47. a	59. b
12. b	24. a	36. c	48. b	60. b

MODULE SET II:
Major Body Systems

Module 7: Circulatory System—Blood

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Circulatory System—Blood	7
2—Circulatory System—Lymphatic	9
3—Composition of Blood	11
4—Erythrocytes, Leukocytes, and Thrombocytes	13
Written Test	15
Answers to Written Test	27
Answers to Assignment Sheet	31
Crossword Puzzles	
1—Terms from Objectives 1 Through 4	33
2—Terms from Objectives 5 Through 7	35
3—Terms from Objectives 8 Through 11	37
4—Terms from Objectives 12 Through 17	39
5—Terms from Objective 18	41
6—Terms from Objective 18 (cont.)	43
Answers to Crossword Puzzles	45
Module Review	47
Answers to Module Review	59

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module is the first of four (Modules 7 through 10) dealing with the circulatory system. Naturally, these modules are extensively interrelated. Review all of the modules and decide how best to present them as a series within your curriculum goals and structure. This review will also help you plan how to deal with questions that may arise during the presentations. For example, in this first module, there is an introduction to the circulatory system but the emphasis is on blood, though references to the heart and vascular system naturally occur, as do references to leukocytes and the lymphatic system. By being familiar with the contents of all four modules and their interrelationships, you will be able to modify the lessons as you deem best for your presentation and to cross-reference the other modules when you feel that it is necessary.

- Use crossword puzzles 1 through 6 to help reinforce the terms in the associated objectives.
- To introduce this module and Objective 1 through Objective 3, provide the students with an overview of the circulatory system, including lymphatics, using illustrations and models. The preceding modules have prepared the students for the vast integration of physiological functioning that will be presented in this module in the circulatory system's role in carrying nutrients, wastes, hormones and other chemicals, and gases. Discuss these roles and relate them to concepts that the students have mastered.
- To supplement Objective 4, locate the organs and other components to be discussed in this series of modules. Use CAT scans and other images, including radiographs with injected dyes, to show the components of the circulatory system. Provide students with actual organs from cows or pigs and dissect them if it is appropriate for your class.
- To supplement Objective 5 through Objective 7, discuss the constituents of blood. Provide prepared slides of blood cells. Visit a blood-donation agency and discuss the importance of blood donations and the procedures used to ensure the safety and quality of the donation procedures. Demonstrate centrifuging blood. View samples of blood plasma, serum, and other stored constituents. Continue your discussion to include the physical and chemical characteristics of blood. Discuss the consequences and possible causes of variances in the normal physical and chemical characteristics of blood. Discuss the composition of blood plasma and the roles of the various constituents. Discuss the role of IV solutions in conjunction with surgical procedures.

  ✔ **NOTE:** For some of these activities, you may want to use an artificial blood such as Ward's blood.

- To supplement Objective 8, use prepared slides and review the nature of erythrocytes (red blood cells). If appropriate for your course, show the students samples of crenated and hemolyzed red blood cells.

- To supplement Objective 9, use prepared slides and review the nature of leukocytes (white blood cells). Use stained cells to distinguish between granulated and agranulated cells. Include all types of leukocytes and relate their functions to your previous studies on the immune system. Show slides or illustrations that portray phagocytosis.
- To supplement Objective 10, use prepared slides and review the nature of thrombocytes (platelets). Demonstrate the effects of anticoagulants by displaying two samples of blood, one of which has had an anticoagulant added.
- To supplement Objective 11 through Objective 13, have a phlebotomist or other specialist discuss the roles of the various types of blood-cell tests. Visit a laboratory to see the various tests being performed. Associate the test parameters with the types of information about patient health that they can provide.
- Discuss Rh factors and blood types, which are presented in Objective 14 through Objective 16. If consistent with your facility's practices, test the type and Rh factor of each student. Help the students understand the compatibility of blood types.
- When discussing Objective 17, recall or repeat your demonstration of blood clotting and provide details of the chemistry of the process. Allow the students to view samples of clotted blood and blood that has not clotted under a microscope.
- Discuss common disorders of the blood, which are presented in Objective 18. Provide students with illustrations and prepared slides of the various types of blood cells associated with these disorders, such as sickle cells and pernicious-anemia cells. Discuss symptoms and treatments for the various disorders.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Ker[illegible]. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites focus on the circulatory system. Internet references in other modules concentrate on the systems specific to those modules. The web-site references provided in the first module set are more general to anatomy and physiology and may also support this module.

- http://www.heartsite.com/index.html

  Although designed for patients with heart-related complaints, this site contains a great deal of information about the heart and its disorders.

- http://sln.fi.edu/biosci/biosci.html

  This site allows students to explore the heart, its structure, and its development and the flow of blood, and its relationship to other body systems. The site also presents information about heart health and the history of heart science.

- http://www.msms.doe.k12.ms.us/biology/anatomy/circulatory/circulatory.html

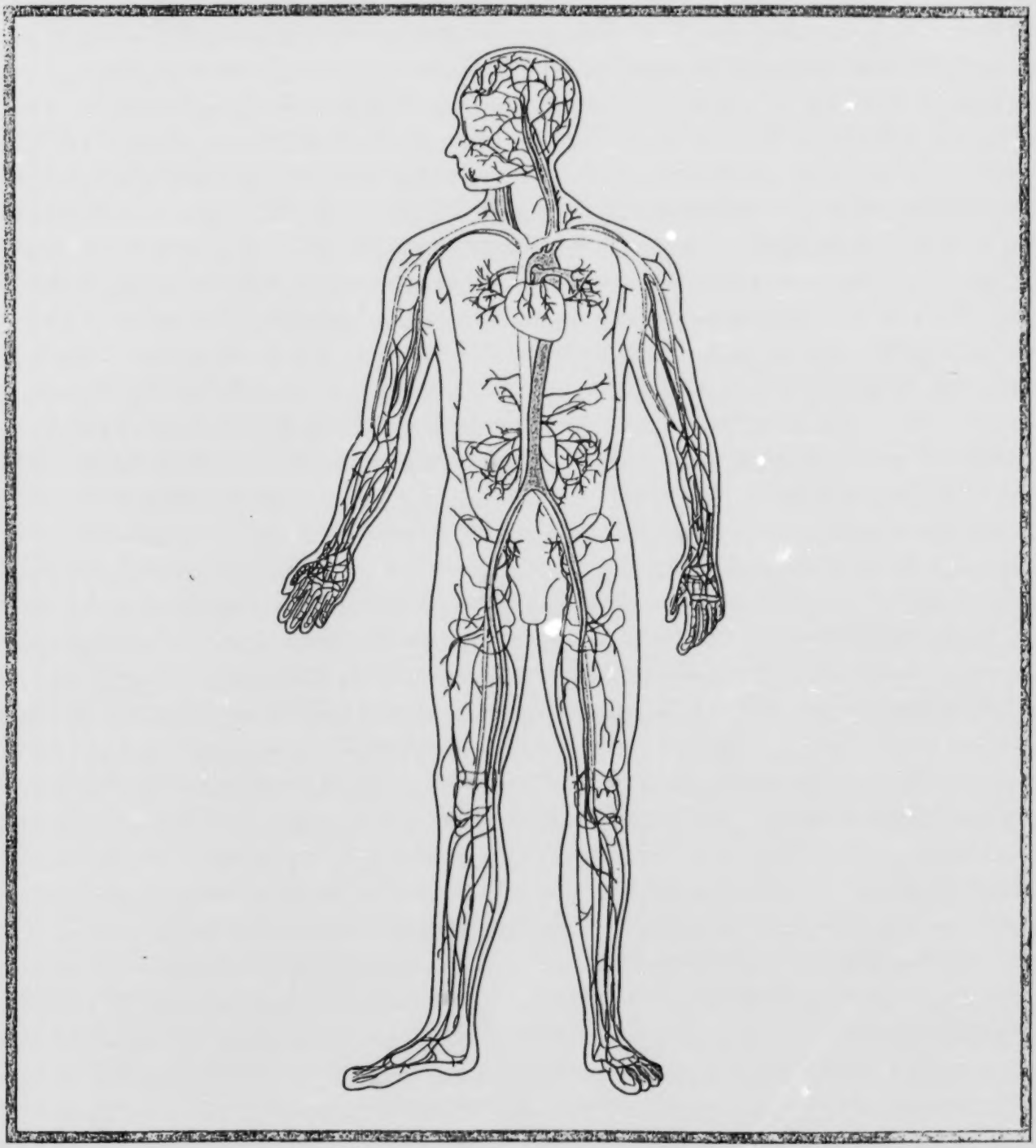
  This site provides good information about the heart, blood vessels, and conduction within the heart.

- http://www.cln.org/themes/circulatory.html

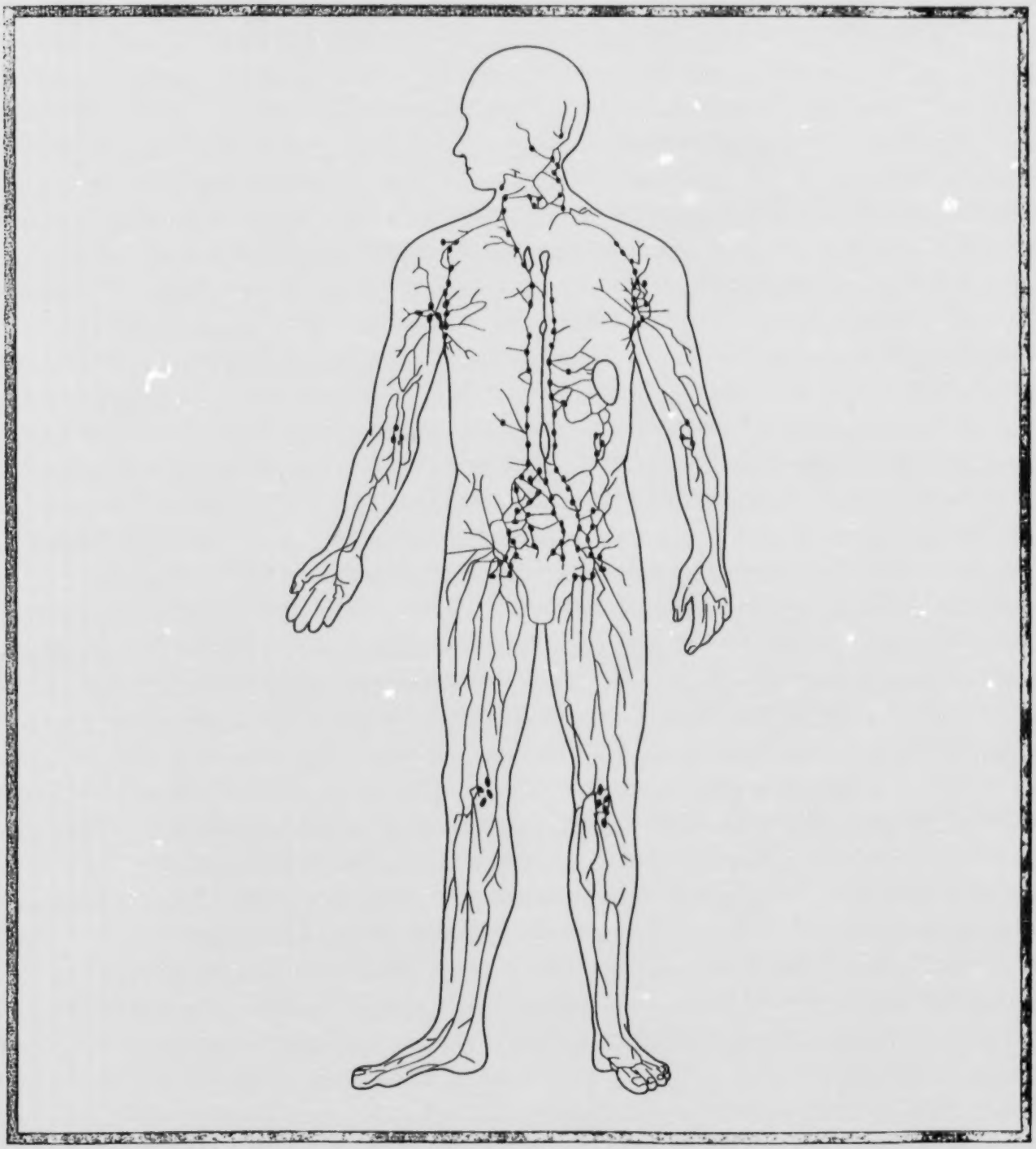
  This web page provides a number of links to sites related to the heart and circulatory system.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

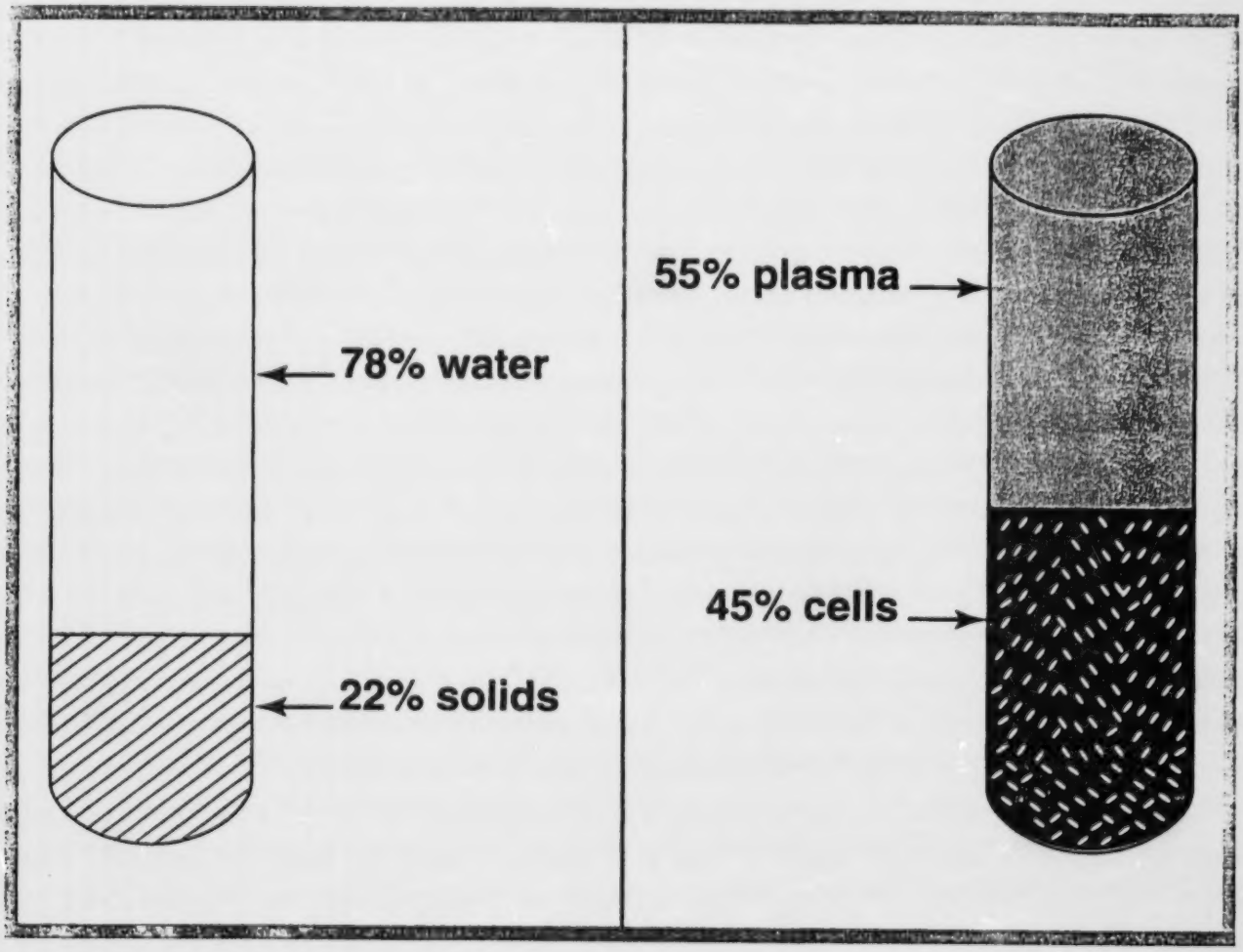
Circulatory System—Blood



Circulatory System—Lymphatic

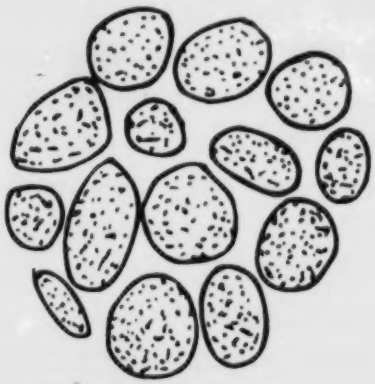


Composition of Blood



Erythrocytes, Leukocytes, and Thrombocytes

Erythrocytes



Thrombocytes

Neutrophil

Eosinophil

Basophil

Granulocytes

Lymphocyte

Monocyte

Agranulocytes

Leukocytes

Written Test

Name _____

Date _____ Score _____

OBJECTIVE 1 Define the term *circulatory system*. Write your answer on the blank lines provided beside the term below.

Circulatory system _____

_____

OBJECTIVE 2 State the functions of the circulatory system. Write your answers on the blank lines provided below.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

e. _____

_____

OBJECTIVE 3 List the subsystems of the circulatory system. Write your answers on the blank lines provided below.

a. _____

b. _____

Objective 4

Match the major organs of the circulatory system to their correct definitions. Write the numbers on the blanks provided.

_____ a. The hollow, muscular organ that by its rhythmic contraction acts as a force-pump maintaining the circulation of the blood

_____ b. The pair of prominent masses of lymphoid tissue that lie on each side of the throat

_____ c. Fine, transparent, valved channels that carry lymph and tissue fluid, are distributed through most tissues, and are characterized by a beaded appearance

_____ d. The many blood vessels that convey blood from the capillaries to the heart

_____ e. The tubular, branching, muscular- and elastic-walled blood vessels that carry blood from the heart through the body

_____ f. Small, oval structures that filter lymph, fight infection, and form lymphocytes, monocytes, and plasma cells

_____ g. A soft, highly vascular organ located between the stomach and the diaphragm and considered a part of the lymphatic system; it produces leukocytes, monocytes, lymphocytes, and plasma cells, stores blood cells, and filters out bacteria and wornout red blood cells

_____ h. The smallest blood vessels forming networks throughout the body

_____ i. The glandular structure of largely lymphoid tissue that is located in the upper anterior chest or at the base of the neck and functions especially in the development of the body's immune system

_____ j. A soft, sponge-like material found in the cavities of the diploe, ribs, sternum, vertebral bones, and proximal epiphysis of the humeri and femurs; it consists of a network of blood vessels and special connective tissue that holds together fat and blood-producing cells

_____ k. The small terminal twigs of an artery that end in capillaries

_____ l. Small veins and especially the minute veins connecting capillaries with larger veins

1. Arteries
2. Arterioles
3. Capillaries
4. Heart
5. Lymph nodes
6. Lymphatic vessels
7. Red bone marrow
8. Spleen
9. Tonsils
10. Thymus
11. Veins
12. Venules

Objective 5 Define the major components of blood. Write your answers on the blank lines provided beside each of the terms below.

a. Blood plasma _____

_____

b. Erythrocytes _____

_____

c. Leukocytes _____

_____

d. Thrombocytes _____

_____

Objective 6 Complete statements that describe the normal physical characteristics of blood. Write your answers on the blank lines provided in the statements below.

a. The color of unoxygenated blood in the veins is _____ or _____.

b. The color of oxygenated blood in the arteries is _____.

c. Blood tastes slightly _____ and _____.

d. Blood is slightly alkaline, with a normal pH of _____ to _____.

e. Blood has a specific gravity of _____ to _____.

f. There are approximately _____ to _____ cubic centimeters of blood in the body.

g. The composition of blood is 78 percent _____ and 22 percent _____ or 55 percent _____ and 45 percent _____.

Objective 7 List the major components of blood plasma. Write your answers on the blank lines provided below and on the next page.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

OBJECTIVE 8

Complete statements that describe the characteristics of erythrocytes. Write your answers on the blank lines provided in the statements below.

a. Erythrocytes look like tiny red _____, with a thinner central area as compared to the edges and a diameter of approximately _____ of an inch.

b. Mature erythrocytes do not contain a _____, and therefore, do not grow.

c. Erythrocytes contain _____, which is the oxygen-carrying red pigment composed of iron and protein.

d. Erythrocytes are formed in _____ at a rate of millions per hour and live for approximately _____ days.

e. Immature erythrocytes are called _____.

f. Erythrocytes break apart or rupture in the capillaries of the _____ and the _____, and as broken and ruptured fragments, are broken down by the _____.

g. Erythrocytes can be destroyed by _____—bleeding, taking blood from a vein; from _____—rupturing of red blood cells—in hypotonic solutions; or from _____—shrinking of red blood cells—in hypertonic solutions.

OBJECTIVE 9

Complete statements that describe the characteristics of leukocytes. Write your answers on the blank lines provided in the statements below and on the next page.

a. Leukocytes are colorless, irregularly shaped cells that may or may not contain granules in their _____.

b. Leukocytes live approximately _____ to _____ days.

c. There are two types of leukocytes: _____ and _____.

d. _____ are leukocytes that have granules in their cytoplasm; _____ are leukocytes that do not have granules in their cytoplasm.

e. There are three types of _____: neutrophils, eosinophils, and basophils.

f. Neutrophils, eosinophils, and basophils are formed in _____.

g. The primary function of _____ is to perform phagocytosis on cellular particles.

h. The primary function of _____ is to perform phagocytosis on larger organisms.

i. The primary function of _____ is to secrete heparin and histamines that are used in the inflammatory response.

j. There are two types of _____: lymphocytes and monocytes.

k. _____ are formed in the lymph nodes.

l. _____ are formed in the cells that line the capillaries of various organs, especially the spleen.

m. The primary function of _____ is to produce antibodies.

n. The primary function of _____ is to perform phagocytosis.

o. Of the total amount of leukocytes in the body, 60 to 70 percent are _____, 20 to 30 percent are _____, and the remaining percentage is composed of trace amounts of the other types of _____.

OBJECTIVE 10 Complete statements that describe the characteristics of thrombocytes. Write your answers on the blank lines provided in the statements below.

a. Thrombocytes are round- or oval-shaped cells in the blood that are formed in the _____ and live for 1 to 4 days.

b. The primary function of thrombocytes is to initiate _____.

Objective 11 Define the term *hematology*. Write your answer on the blank lines provided beside the term below.

Hematology _____

_____

Objective 12 Define common tests used in hematologic studies. Write your answers on the blank lines provided beside each of the terms below.

a. Complete blood count _____

_____

_____

b. White-blood-cell count _____

_____

c. Red-blood-cell count _____

_____

d. Hematocrit _____

_____

e. Hemoglobin _____

_____

f. Platelet count _____

_____

g. Reticulocyte count _____

_____

Objective 13 State the normal parameters of the common tests used in hematologic studies. Write your answers on the blank lines provided beside each of the terms below and on the next page.

Adult males

a. White-blood-cell count _____

b. Red-blood-cell count _____

c. Hematocrit value _____

d. Hemoglobin value _____

e. Platelet count _____

f. Reticulocyte count _____

Adult females

g. White-blood-cell count _____

h. Red-blood-cell count _____

i. Hematocrit value _____

j. Hemoglobin value _____

k. Platelet count _____

l. Reticulocyte count _____

OBJECTIVE 14

Complete statements that describe the characteristics of the Rh blood-group factor. Write your answers on the blank lines provided in the statements below.

a. The Rh factor is an antigen that may or may not be present in the _____ of people.

b. Persons with the antigen present in their red blood cells are referred to as _____ and represent about 85 percent of all individuals.

c. Persons without the antigen present in their red blood cells are referred to as _____.

d. A person's Rh factor becomes critical in two instances: blood transfusions and pregnancy. During blood transfusions, an _____ person must not be given _____ blood because the recipient's blood system will produce antibodies that attack the erythrocytes in the donated blood.

e. If, during pregnancy, an _____ mother is carrying an _____ fetus, the mother may become sensitized to the proteins produced by the fetus. In a subsequent pregnancy, the mother's antibodies may pass to the fetus and destroy the fetus' erythrocytes. This condition in the fetus is called _____, which is generally treated by providing the baby with a complete blood replacement with _____ blood immediately after birth.

OBJECTIVE 15

Complete statements that describe the characteristics of the human blood groups (blood types). Write your answers on the blank lines provided in the statements below.

a. Human blood is divided into four blood groups or types based on the presence or absence of blood antigens called _____ on the surface of red blood cells.

b. The four blood groups are _____, _____, _____, and _____.

c. Type _____ blood has A antigen; type _____ blood has B antigen; type _____ blood has both A and B antigens; and type _____ blood has neither A nor B antigens.

d. A person's blood group must be considered for _____.

e. Persons with type _____ blood represent 41 percent of the population, and they can donate blood to persons with type A or type AB blood and receive blood from persons with type A or type O blood.

f. Persons with type _____ blood represent 10 percent of the population, and they can donate blood to people with type B or type AB blood and receive blood from people with type B or type O blood.

g. Persons with type _____ blood represent 4 percent of the population, and they can donate blood to people with type AB blood and receive blood from people with type A, B, AB, or O blood.

h. Persons with type _____ blood represent 45 percent of the population, and they can donate blood to people with type A, B, AB, or O blood and receive blood from people with type O blood.

OBJECTIVE 16

Describe the factors that must be considered when blood is matched for a transfusion. Write your answers on the blank lines provided below and on the next page.

a. _____

_____

_____

_____

b. _____

_____

_____

_____

OBJECTIVE 17

Complete statements that describe the blood-clotting process (blood coagulation). Write your answers on the blank lines provided in the statements below.

a. Blood clotting consists of two aspects—_____ and _____.

b. The _____ aspect involves the entrapment of platelets, while the _____ aspect involves proteins that are present in the blood and are released by the liver to form a mechanical trap that catches blood cells.

c. The liver releases the plasma proteins _____ and _____.

d. When cells are injured, platelets are snagged in the walls of blood vessels and release a complex substance called _____.

e. _____ and _____ form the enzyme thrombin in plasma.

f. Thrombin and fibrinogen form an insoluble protein called _____, which creates a network of fine "threads" that catch red blood cells.

g. The thread network and captured cells form a _____, which is another term for a blood clot.

Objective 18

Match common disorders and abnormalities of the blood to their correct definitions. Write the numbers on the blanks provided below and on the next page.

_____ a. A condition in which the white-blood-cell count is abnormally high, often as a result of an infection

_____ b. Any condition, such as Rh disease or malaria, that causes the red blood cells to rupture prematurely before the end of their normal life span

_____ c. An abnormal vascular condition in which thrombus develops within a blood vessel of the body

_____ d. A condition in which the white-blood-cell count is abnormally low, usually caused by an adverse drug reaction, radiation poisoning, or pathologic conditions

_____ e. Any of several blood defects in which there is an inadequate number of red blood cells or an insufficient amount of hemoglobin that is characterized by fatigue, dizziness, headache, insomnia, and pallor

_____ f. A condition in which the Rh factor of the mother's blood and that of her newborn are not compatible

_____ g. An abnormal circulatory condition in which an embolus travels through the bloodstream and becomes lodged in a blood vessel

_____ h. A condition of low hemoglobin as a result of insufficient dietary iron

_____ i. A clotting disorder that results from abnormally low platelet counts, usually caused by bone-marrow destruction

_____ j. A genetic disorder in which a person's blood fails to clot properly

_____ k. A condition in which the red bone marrow ceases to produce adequate numbers of red blood cells, usually as a result of exposure to radiation or chemicals

_____ l. A severe, chronic, incurable genetic disorder in which the hemoglobin causes the red blood cells to curl and rupture, leading to clogged capillaries and characterized by joint pain, lethargy, and weakness

1. Anemia
2. Aplastic anemia
3. Embolism
4. Hemolytic anemia
5. Hemophilia
6. Iron-deficiency anemia
7. Jaundice
8. Leukemia
9. Leukocytosis
10. Leukopenia
11. Pernicious anemia
12. Rh disease
13. Sickle-cell anemia
14. Thrombocytopenia
15. Thrombosis

_____ m. A yellow discoloration of the skin, mucous membranes, and eyes that is caused by greater-than-normal amounts of bilirubin in the blood

_____ n. A condition in which the red blood cells are large, misshapen, and fragile due to a lack of vitamin B_{12} in the diet or an inability of the body to process vitamin B_{12}, often as a result of an autoimmune destruction of the parietal cells of the stomach lining

_____ o. A malignancy of the blood-forming tissues that results in excessive production of immature white blood cells

Answers to Written Test

Objective 1

The network of channels through which the nutrient fluids of the body circulate

Objective 2

Answers may appear in any order.

a. Transports various substances to and from body cells, including oxygen, carbon dioxide, food, water, chemicals, hormones, and waste products

b. Protects the body against invading organisms

c. Helps to regulate body temperature

d. Maintains homeostasis

e. Transports waste products to excretory organs

Objective 3

Answers may appear in any order.

a. Blood circulatory system
b. Lymphatic system

Objective 4

a. 4	d. 11	g. 8	j. 7
b. 9	e. 1	h. 3	k. 2
c. 6	f. 5	i. 10	l. 12

Objective 5

a. The liquid part of blood that serves as a source of nutrition and a means of removing waste products from the cells of the body

b. Red blood cells (RBCs) that transport oxygen and carbon dioxide in support of respiration

c. White blood cells (WBCs) that ingest and digest foreign particles in blood, form antibodies, and release heparin

d. Blood platelets, the tiny protoplasmic discs of the blood that assist in blood clotting

Objective 6

a. purple; deep red
b. bright red
c. metallic; salty
d. 7.35; 7.45
e. 1.050; 1.065
f. 5000; 5500
g. water; solids; plasma; cells

Objective 7

Answers may appear in any order.

a. Water
b. Electrolytes
c. The nutrients glucose, amino acids, and fat
d. Metabolic wastes, including urea, uric acid, creatinine, and lactic acid
e. Respiratory gases
f. Regulatory substances, including hormones and enzymes
g. Antibodies

Objective 8

a. discs; 1/3000
b. nucleus
c. hemoglobin
d. red bone marrow; 120
e. reticulocytes
f. liver; spleen; liver
g. mechanical means; hemolysis; crenation

Objective 9

a. cytoplasm
b. 1; 12
c. granulocytes; agranulocytes
d. Granulocytes; agranulocytes
e. granulocytes
f. red bone marrow
g. neutrophils
h. eosinophils
i. basophils
j. agranulocytes
k. Lymphocytes
l. Monocytes
m. lymphocytes
n. monocytes
o. neutrophils; lymphocytes; white blood cells

Objective 10

a. red bone marrow
b. blood clotting

Objective 11

The scientific study of blood and blood-forming tissues

Objective 12

a. A screening test that provides diagnostic information concerning the number, type, percentage, concentration, and quality of various blood cells

b. A test used to determine the total number of white blood cells in a cubic millimeter of blood

c. A count of the number of red blood cells per cubic millimeter of blood

d. A test that determines the percentage of red blood cells in the plasma of a total blood sample

e. A test to determine the hemoglobin concentration in red blood cells in order to screen for anemia

f. A test used to determine the total number of platelets in a cubic millimeter of blood

g. A test used to determine the percentage of immature red blood cells of the total of all red blood cells in a blood sample

Objective 13

a. 5000 to 10,000 per cubic millimeter of blood
b. 4.6 to 6.2 million per cubic millimeter of blood
c. 40 to 50 percent
d. 13 to 18 grams per deciliter
e. 200,000 to 500,000 per cubic millimeter
f. 0.5 to 1.5 percent of all red blood cells
g. 5000 to 10,000 per cubic millimeter of blood
h. 4.2 to 5.4 million per cubic millimeter of blood
i. 37 to 47 percent
j. 12 to 16 grams per deciliter
k. 200,000 to 500,000 per cubic millimeter
l. 0.5 to 2.5 percent of all red blood cells

Objective 14

a. red blood cells
b. Rh positive
c. Rh negative
d. Rh negative; Rh positive
e. Rh negative; Rh positive; erythroblastosis fetalis; Rh negative

Objective 15

a. agglutinogens
b. A; B; AB; O
c. A; B; AB; O
d. transfusions
e. A
f. B
g. AB
h. O

Objective 16

Answers may appear in any order.

a. There are four blood groups, each of which can be either Rh negative or Rh positive.

b. When blood is matched, both the blood type and the Rh factor must be considered; thus, blood is referred to by both its blood type and its Rh factor, such as O+, AB–, etc.

Objective 17

a. mechanical; chemical
b. mechanical; chemical
c. prothrombin; fibrinogen
d. thromboplastin
e. Prothrombin; thromboplastin
f. fibrin
g. thrombus

Objective 18

a. 9	d. 10	g. 3	j. 5	m. 7
b. 4	e. 1	h. 6	k. 2	n. 11
c. 15	f. 12	i. 14	l. 13	o. 8

Answers to Assignment Sheet

Assignment Sheet 1

CASE STUDY 1

Suggested answers

Initially the patient may appear pale and cool to the touch. There will be a drop in blood pressure and decrease in urinary output. The patient may complain of dizziness and will eventually become unconscious. The heart rate will increase but will become erratic as the blood volume continues to decrease. As the heart has less and less blood to pump, it will begin to deteriorate and can reach a point of irreversible damage. If the blood loss continues much beyond that point, the patient will die.

The early responses are to preserve as much body fluid as possible and to maintain cardiac output at a level as near to normal as possible. Later responses are desperate attempts to preserve blood flow to the vital organs. Beyond a certain point, there is no longer enough blood to promote these purposes and the heart becomes erratic.

Attempts to prevent blood loss should begin by trying to increase clotting. This can be done by applying a rough covering such as gauze to the wound or by applying heat or slight pressure. If the wound is extensive, more pressure may be required; however, tourniquets should be used only as a last resort. Clotting may also be promoted through the use of medications such as purified thrombin or fibrin materials.

CASE STUDY 2

The report should address substances such as Fluosol and Poly Heme as well as the latest developments in this area of research.

CASE STUDY 3

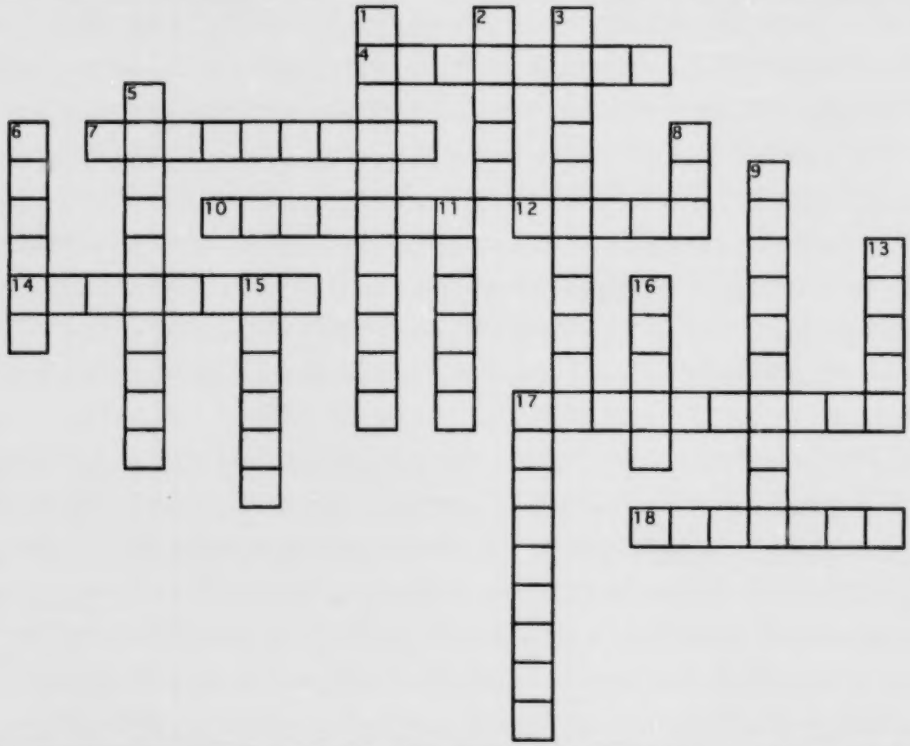
Answers must be evaluated by the instructor, according to the procedures of the assigned facility.

CASE STUDY 4

The athlete should be informed that there is always a risk with any medical procedure, especially those that involve venipuncture and blood transfusions—which this practice in essence is. Some of the risks include hemorrhaging, collapsed veins, potential aneurysm, formation of a thrombus or embolism, contamination of the blood, and nosocomial infections. There is no convincing research that blood-doping is effective in enhancing performance, and any enhancement of performance in a healthy person would be minimal and just due to the physiological considerations.

Crossword Puzzle 1—Terms from Objectives 1 Through 4

Name _____ Date _____



ACROSS

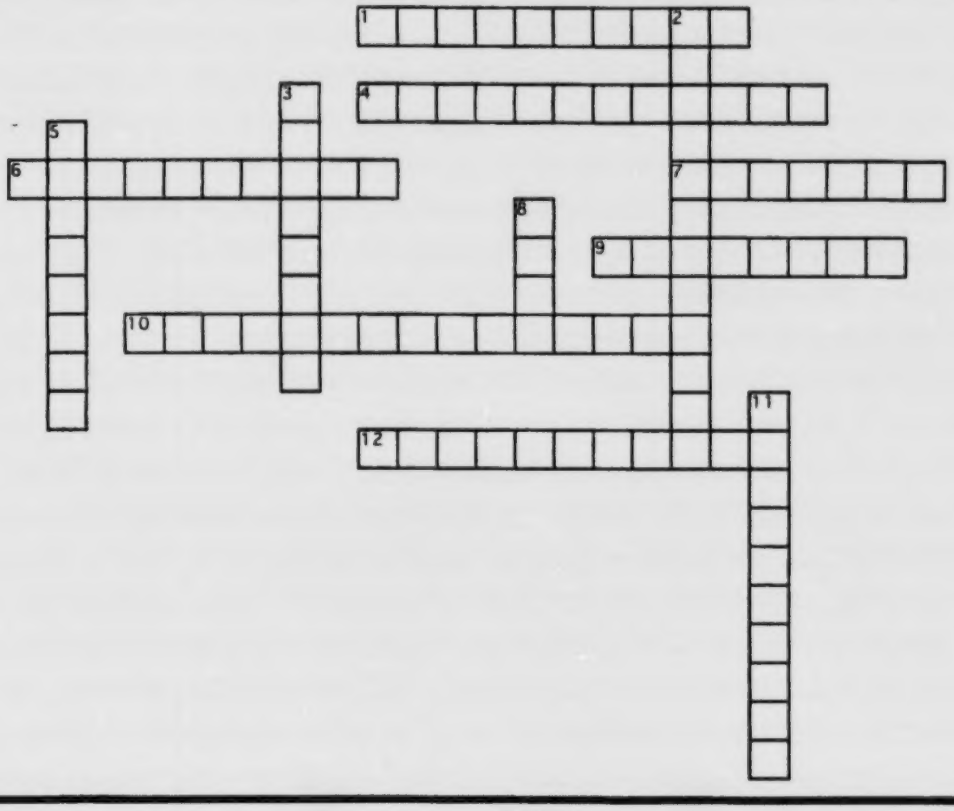
4. The tubular, branching, muscular- and elastic-walled blood vessels that carry blood from the heart through the body
7. _____ vessels are fine, transparent, valved channels that carry lymph and tissue fluid, are distributed through most tissues, and are characterized by a beaded appearance
10. Small veins and especially the minute veins connecting capillaries with larger veins
12. The liquid pumped by the heart through the arteries, veins, and capillaries, carrying nourishment and oxygen to and bringing away waste products from all parts of the body
14. A type of white blood cell that enlarges to form a macrophage in order to perform more-rapid phagocytosis
17. Small, oval structures that filter lymph, fight infection, and form lymphocytes, monocytes, and plasma cells (2 words)
18. The pair of prominent masses of lymphoid tissue that lie on each side of the throat

DOWN

1. The smallest blood vessels forming networks throughout the body
2. The hollow, muscular organ that by its rhythmic contraction acts as a force-pump maintaining the circulation of the blood
3. The _____ system is the network of channels through which the nutrient fluids of the body circulate
5. One of two types of white blood cells—a T cell or a B cell—that performs various functions related to recognizing, marking, and remembering pathogens based on their antigens
6. The fluid part of blood and lymph
8. _____ bone marrow is a soft, sponge-like material found in the cavities of the diploe, ribs, sternum, vertebral bones, and proximal epiphysis of the humeri and femurs; it consists of a network of blood vessels and special connective tissue that holds together fat and blood-producing cells
9. The small terminal twigs of an artery that end in capillaries
11. A soft, highly vascular organ located between the stomach and the diaphragm and considered a part of the lymphatic system; it produces leukocytes, monocytes, lymphocytes, and plasma cells, stores blood cells, and filters out bacteria and wornout red blood cells
13. The many blood vessels that convey blood from the capillaries to the heart
15. The glandular structure of largely lymphoid tissue that is located in the upper anterior chest or at the base of the neck and functions especially in the development of the body's immune system
16. The pale fluid that bathes the tissues, passes into lymphatic vessels and ducts, and is discharged into the blood
17. Another term for white blood cell

Crossword Puzzle 2—Terms from Objectives 5 Through 7

Name _____ Date _____



ACROSS

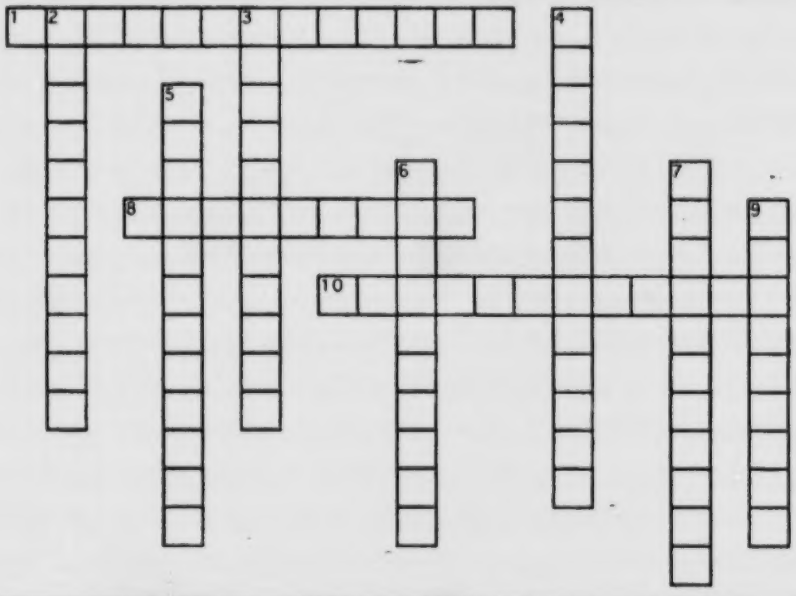
1. White blood cells (WBCs) that ingest and digest foreign particles in blood, form antibodies, and release heparin
4. Blood platelets, the tiny protoplasmic discs of the blood that assist in blood clotting
6. A substance that is formed from the metabolism of creatine and is commonly found in blood, urine, and muscle tissue
7. A chemical that prevents blood from clotting
9. The process of blood becoming solid
10. A comparison of the mass (weight) of a liquid compared to an equal volume of water (2 words)
12. The liquid part of blood that serves as a source of nutrition and a means of removing waste products from the cells of the body (2 words)

DOWN

2. Red blood cells (RBCs) that transport oxygen and carbon dioxide in support of respiration
3. A product of the metabolism of protein that is present in the blood and excreted in the urine (2 words)
5. An important nitrogenous compound produced by metabolic processes in the body; combined with phosphorus, it forms a high-energy phosphate
8. A nitrogen-rich waste product formed in the liver
11. An organic acid that results from anaerobic cell respiration (2 words)

Crossword Puzzle 3—Terms from Objectives 8 Through 11

Name _____ Date _____



ACROSS

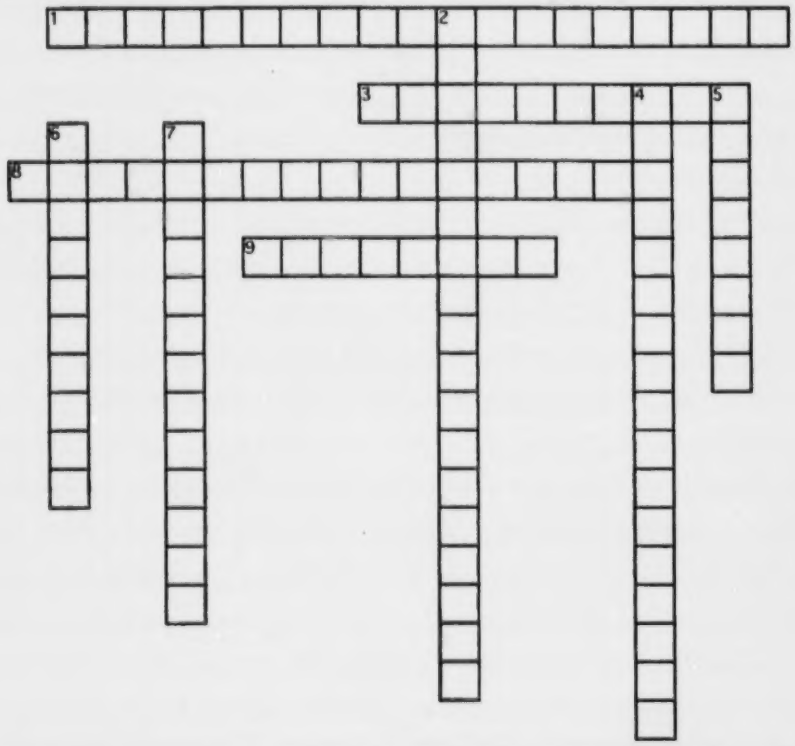
1. Immature erythrocytes
8. Agranulocytes that perform phagocytosis
10. Leukocytes that have granules in their cytoplasm

DOWN

2. Granulocytes that perform phagocytosis on larger organisms
3. Agranulocytes that produce antibodies
4. Leukocytes that do not have granules in their cytoplasm
5. Round- or oval-shaped cells in the blood with the primary function of initiating blood clotting
6. The scientific study of blood and blood-forming tissues
7. Granulocytes that perform phagocytosis on cellular particles
9. Granulocytes that secrete heparin and histamines that are used in the inflammatory response

Crossword Puzzle 4—Terms from Objectives 12 Through 17

Name _____ Date _____



ACROSS

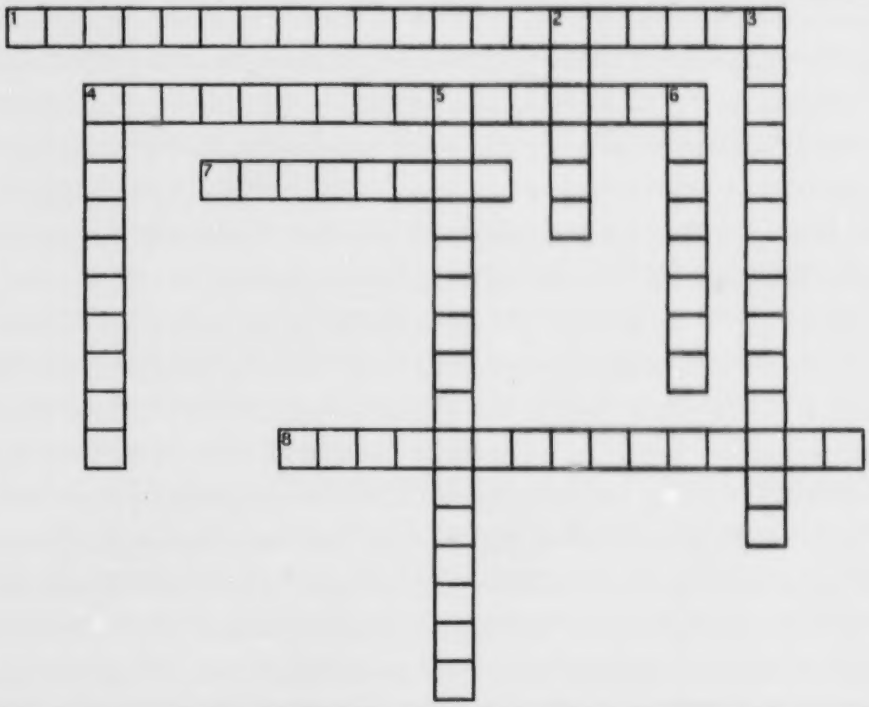
1. A test used to determine the total number of white blood cells in a cubic millimeter of blood (4 words)
3. A test that determines the percentage of red blood cells in the plasma of a total blood sample; to separate blood
8. A count of the number of red blood cells per cubic millimeter of blood (4 words)
9. An antigen that may or may not be present in the red blood cells of people and must be determined in blood transfusions and pregnancy (2 words)

DOWN

2. A screening test that provides diagnostic information concerning the number, type, percentage, concentration, and quality of various blood cells (3 words)
4. A test used to determine the percentage of immature red blood cells of the total of all red blood cells in a blood sample (2 words)
5. Another term for a blood clot
6. A test to determine the hemoglobin concentration in red blood cells in order to screen for anemia
7. A test used to determine the total number of platelets in a cubic millimeter of blood (2 words)

Crossword Puzzle 5—Terms from Objective 18

Name _____ Date _____



ACROSS

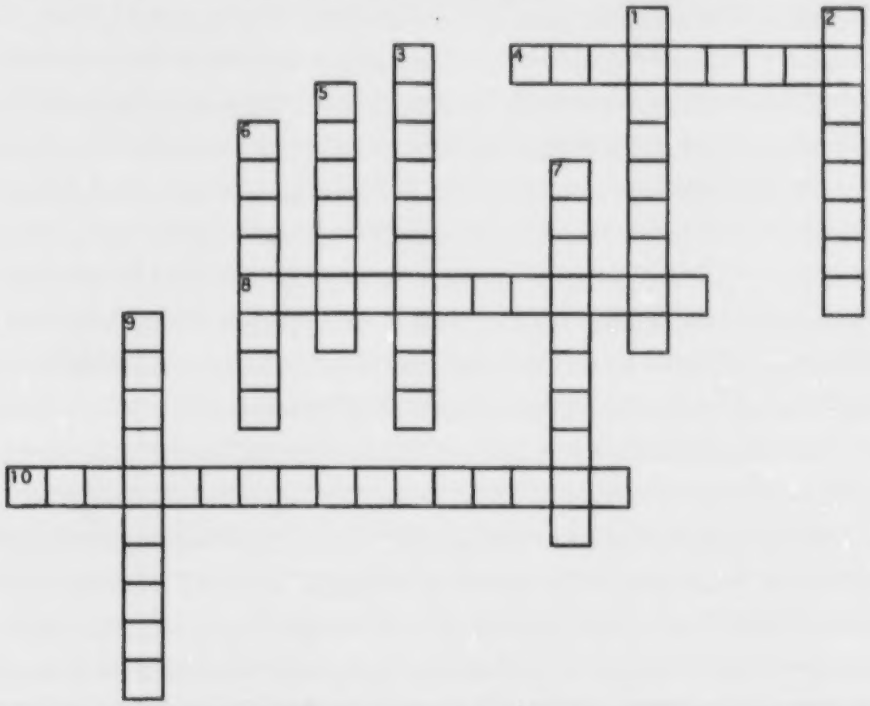
1. A condition of low hemoglobin as a result of insufficient dietary iron (3 words)
4. A condition in which the red blood cells are large, misshapen, and fragile due to a lack of vitamin B_{12} in the diet or an inability of the body to process vitamin B_{12}, often as a result of an autoimmune destruction of the parietal cells of the stomach lining (2 words)
7. A yellow discoloration of the skin, mucous membranes, and eyes that is caused by greater-than-normal amounts of bilirubin in the blood
8. Any condition, such as Rh disease or malaria, that causes the red blood cells to rupture prematurely before the end of their normal life span (2 words)

DOWN

2. Any of several blood defects in which there is an inadequate number of red blood cells or an insufficient amount of hemoglobin that is characterized by fatigue, dizziness, headache, insomnia, and pallor
3. A condition in which the red bone marrow ceases to produce adequate numbers of red blood cells, usually as a result of exposure to radiation or chemicals (2 words)
4. Potentially injurious, destructive, or fatal unless treated
5. A severe, chronic, incurable genetic disorder in which the hemoglobin causes the red blood cells to curl and rupture, leading to clogged capillaries and characterized by joint pain, lethargy, and weakness (3 words)
6. Pertaining to the absence or defective development of a tissue or organ

Crossword Puzzle 6—Terms from Objective 18 (cont.)

Name _____ Date _____



ACROSS

4. A condition in which the Rh factor of the mother's blood and that of her newborn are not compatible (2 words)
8. A condition in which the white-blood-cell count is abnormally high, often as a result of an infection
10. A clotting disorder that results from abnormally low platelet counts, usually caused by bone-marrow destruction

DOWN

1. The orange-yellow pigment of bile that is formed principally by the breakdown of hemoglobin in red blood cells after termination of their normal lifespan
2. A malignancy of the blood-forming tissues that results in excessive production of immature white blood cells
3. An abnormal vascular condition in which thrombus develops within a blood vessel of the body
5. A foreign object, a quantity of air or gas, a bit of tissue or tumor, or a piece of thrombus that circulates in the bloodstream until it becomes lodged in a vessel
6. An abnormal circulatory condition in which an embolus travels through the bloodstream and becomes lodged in a blood vessel
7. A genetic disorder in which a person's blood fails to clot properly
9. A condition in which the white-blood-cell count is abnormally low, usually caused by an adverse drug reaction, radiation poisoning, or pathologic conditions

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
4. ARTERIES
7. LYMPHATIC
10. VENULES
12. BLOOD
14. MONOCYTE
17. LYMPH NODES
18. TONSILS

DOWN
1. CAPILLARIES
2. HEART
3. CIRCULATORY
5. LYMPHOCYTE
6. PLASMA
8. RED
9. ARTERIOLES
11. SPLEEN
13. VEINS
15. THYMUS
16. LYMPH
17. LEUKOCYTE

Crossword Puzzle 2

ACROSS
1. LEUKOCYTES
4. THROMBOCYTES
6. CREATININE
7. HEPARIN
9. CLOTTING
10. SPECIFIC GRAVITY
12. BLOOD PLASMA

DOWN
2. ERYTHROCYTES
3. URIC ACID
5. CREATINE
8. UREA
11. LACTIC ACID

Crossword Puzzle 3

ACROSS
1. RETICULOCYTES
8. MONOCYTES
10. GRANULOCYTES

DOWN
2. EOSINOPHILS
3. LYMPHOCYTES
4. AGRANULOCYTES
5. THROMBOCYTES
6. HEMATOLOGY
7. NEUTROPHILS
9. BASOPHILS

Crossword Puzzle 4

ACROSS
1. WHITE BLOOD CELL COUNT
3. HEMATOCRIT
8. RED BLOOD CELL COUNT
9. RH FACTOR

DOWN
2. COMPLETE BLOOD COUNT
4. RETICULOCYTE COUNT
5. THROMBUS
6. HEMOGLOBIN
7. PLATELET COUNT

Crossword Puzzle 5

ACROSS
1. IRON DEFICIENCY ANEMIA
4. PERNICIOUS ANEMIA
7. JAUNDICE
8. HEMOLYTIC ANEMIA

DOWN
2. ANEMIA
3. APLASTIC ANEMIA
4. PERNICIOUS
5. SICKLE CELL ANEMIA
6. APLASTIC

Crossword Puzzle 6

ACROSS
4. RH DISEASE
8. LEUKOCYTOSIS
10. THROMBOCYTOPENIA

DOWN
1. BILIRUBIN
2. LEUKEMIA
3. THROMBOSIS
5. EMBOLUS
6. EMBOLISM
7. HEMOPHILIA
9. LEUKOPENIA

Module Review

Name _____

Date _____ Score _____

Directions Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 17

1. _____ is another term for a blood clot.

   a. *Thrombin*

   b. *Thrombus*

   c. *Thromboplastin*

   d. *Prothrombin*

Objective 18

2. An embolus is a _____ that circulates in the bloodstream until it becomes lodged in a vessel.

   a. foreign object or quantity of gas or air

   b. bit of tissue or tumor

   c. both "a" and "b"

   d. neither "a" nor "b"

Objective 15

3. Type _____ is the least-common blood type.

   a. A

   b. B

   c. AB

   d. O

Objective 17

4. The _____ releases prothrombin and fibrinogen.

   a. liver

   b. spleen

   c. red bone marrow

   d. yellow bone marrow

Objective 9

5. Which of the following is NOT a type of granulocyte?

   a. neutrophil

   b. eosinophil

   c. basophil

   d. leukophil

Objective 18

6. A condition in which the white-blood-cell count is abnormally low is referred to as _____.

   a. *thrombosis*

   b. *embolism*

   c. *thrombocytopenia*

   d. *leukopenia*

Objective 15

7. Which blood type can receive blood from the other three blood types and is called the *universal recipient*?

   a. A

   b. B

   c. AB

   d. O

Objective 14

8. What is the likely result if a woman with Rh negative blood carries a fetus with Rh positive blood?

   a. The fetus' blood will become Rh neutral.

   b. The mother's blood will become Rh neutral.

   c. The antibodies produced in the mother are likely to attack the red blood cells of that fetus.

   d. The antibodies produced in the mother are likely to attack the red blood cells of the fetus of a subsequent pregnancy.

Objective 18

9. _____ is a condition of excessively high bilirubin.

   a. Anemia

   b. Jaundice

   c. Leukemia

   d. Hemophilia

Objective 8

10. Which of the following is NOT a true statement about red blood cells?

    a. As broken and ruptured fragments, they are broken down by the spleen.

    b. They can undergo mechanical destruction as a result of bleeding.

    c. They undergo hemolysis in hypotonic solutions.

    d. They undergo crenation in hypertonic solutions.

Objective 18

11. _____ is any of several blood defects in which there is an inadequate number of red blood cells or an insufficient amount of hemoglobin.

    a. Anemia

    b. Jaundice

    c. Leukemia

    d. Hemophilia

Objective 11

12. _____ is the scientific study of blood and blood-forming tissues.

    a. Hemoglobin

    b. Hematocrit value

    c. Hematology

    d. Biology

Objective 18

13. A condition in which a blood clot is transported through the blood system and becomes lodged in a blood vessel is called _____.

    a. *thrombosis*

    b. *embolism*

    c. *thrombocytopenia*

    d. *leukopenia*

Objective 13

14. A normal hemoglobin value is _____ grams per deciliter for men and _____ grams per deciliter for women.

    a. 13 to 18; 12 to 16

    b. 16 to 18; 10 to 12

    c. 12 to 16; 14 to 18

    d. 14 to 18; 12 to 16

Objective 15

15. Type _____ is the most-common blood type.

a. A

b. B

c. AB

d. O

Objective 18

16. _____ is a genetic disorder in which a person's blood fails to clot properly.

a. Anemia

b. Jaundice

c. Leukemia

d. Hemophilia

Objective 12

17. A reticulocyte count is used to determine _____.

a. the total number of white blood cells in a milliliter of blood

b. the total number of red blood cells per cubic centimeter of blood

c. the percentage of immature red blood cells in a blood sample

d. the number, type, percentage, concentration, and quality of various blood cells

Objective 9

18. Agranulocytes include _____.

a. lymphocytes and monocytes

b. leukocytes and polycytes

c. lymphophils and monophils

d. leukophils and polyphils

Objective 14

19. Persons with a red-blood-cell protein antigen are referred to as _____.

a. *Rh negative*

b. *Rh positive*

c. *pH positive*

d. *pH negative*

Objective 18

20. A clotting disorder that results from abnormally low platelet-cell counts, usually caused by bone-marrow destruction is _____.

    a. thrombosis

    b. embolism

    c. thrombocytopenia

    d. leukopenia

Objective 13

21. By volume, a normal erythrocyte count for adult males is _____ cells per cubic millimeter of blood.

    a. 45 to 55 thousand

    b. 4.6 to 5.9 thousand

    c. 4.6 to 6.2 million

    d. 45 to 55 million

Objective 5

22. _____ ingest and digest foreign particles in blood, form antibodies, and release _____.

    a. Leukocytes; heparin

    b. Leukocytes; carbon dioxide

    c. Erythrocytes; heparin

    d. Erythrocytes; carbon dioxide

Objective 18

23. _____ anemia is a condition in which the red blood cells are large, misshapen, and fragile due to a lack of vitamin B_{12} in the diet or an inability of the body to process vitamin B_{12}, often as a result of an autoimmune destruction of the parietal cells of the stomach lining.

    a. Pernicious

    b. Sickle-cell

    c. Iron-deficiency

    d. Hemolytic

Objective 4

24. Pumping blood to maintain the circulation of the blood is the function of the _____.

    a. heart

    b. vessels

    c. spleen

    d. lymph nodes

Objective 7

25. Blood plasma contains _____.

a. electrolytes and respiratory gases

b. nutrients, metabolic wastes, and water

c. antibodies

d. all of the above

Objective 17

26. When cells are injured, platelets are snagged in the walls of blood vessels and release _____.

a. thrombin

b. thromboplastin

c. fibrin

d. thrombus

Objective 10

27. Which of the following statements is NOT true about thrombocytes?

a. They are round or oval cells.

b. They regulate blood pressure.

c. They are formed in the red bone marrow.

d. They live 1 to 4 days.

Objective 6

28. Oxygenated blood in the arteries is _____.

a. purple

b. blue

c. dark red

d. bright red

Objective 18

29. _____ is a malignancy of the blood-forming tissues that results in excessive production of immature white blood cells.

a. Anemia

b. Jaundice

c. Leukemia

d. Hemophilia

Objective 6

30. Which of the following represents the correct proportions of blood constituents?

a. 78 percent water and 22 percent solids

b. 45 percent plasma and 55 percent cells

c. both "a" and "b"

d. neither "a" nor "b"

Objective 8

31. Red blood cells _____.

a. are formed at a rate of thousands per day

b. live for approximately 20 days

c. break apart or rupture in the capillaries of the heart and lungs

d. can be destroyed by mechanical means

Objective 16

32. When blood is matched, it is referred to by both its _____.

a. blood type and Rh factor

b. blood type and pH factor

c. hematocrit value and hemoglobin value

d. platelet count and hematocrit value

Objective 6

33. The normal pH of blood is approximately _____.

a. 6.95 to 7.05

b. 7.15 to 7.25

c. 7.35 to 7.45

d. 7.55 to 7.65

Objective 15

34. Which blood type can give blood to the other three blood types and is called the *universal donor*?

a. A

b. B

c. AB

d. O

Objective 8

35. Which of the following is a correct description of erythrocytes?

a. red, tiny, disc-shaped cells with a thinner central area as compared to the edges

b. red, tiny, egg-shaped cells with a thinner central area as compared to the edges

c. red, tiny, disc-shaped cells with a thicker central area as compared to the edges

d. red, tiny, egg-shaped cells with a thicker central area as compared to the edges

Objective 17

36. _____ form fibrin, which creates a network of fine "threads" that catch red blood cells.

a. Prothrombin and thromboplastin

b. Prothrombin and fibrinogen

c. Thrombin and fibrinogen

d. Thrombin and thromboplastin

Objective 5

37. _____ is the liquid part of blood that serves as a source of nutrition and a means of removing waste products from the body cells.

a. Blood serum

b. Glucose

c. Fibrin

d. Blood plasma

Objective 6

38. The specific gravity of blood is approximately _____.

a. 0.080 to 0.095

b. 1.050 to 1.065

c. 1.080 to 1.095

d. 1.150 to 1.165

Objective 2

39. Which of the following is NOT a function of the circulatory system?

a. protects the body against invading organisms

b. helps to regulate body temperature

c. prevents homeostasis

d. transports waste products to excretory organs

Objective 14

40. _____ individuals have a red-blood-cell protein antigen referred to as the *Rh factor.*

a. All

b. Most

c. Approximately 50 percent of

d. Approximately 85 percent of

Objective 4

41. The spleen produces _____.

a. leukocytes and blood cells

b. leukocytes and monocytes

c. leukocytes and red bone marrow

d. blood cells and red bone marrow

Objective 13

42. A normal hematocrit value is _____ percent for men and _____ percent for women.

a. 42 to 50; 40 to 48

b. 40 to 50; 37 to 47

c. 52 to 60; 50 to 58

d. 50 to 58; 52 to 60

Objective 9

43. Neutrophils, eosinophils, and basophils are formed in the _____.

a. spleen

b. lymph nodes

c. red bone marrow

d. thymus

Objective 3

44. The major subsystems of the circulatory system are the _____ and _____ systems.

a. blood; lymphatic

b. arteries; veins

c. lymphatic vessels; nodes

d. lymphocytes; monocytes

Objective 14

45. If an Rh negative person is given Rh positive blood, _____.

    a. the two types of blood will not mix

    b. Rh neutral blood will be produced

    c. the donated blood will produce antibodies that will attack the erythrocytes in the recipient's blood

    d. the recipient's blood system will produce antibodies that will attack the erythrocytes in the donated blood

Objective 1

46. The circulatory system is the network of channels through which the _____ fluids of the body circulate.

    a. excretory

    b. lymphatic

    c. plasma

    d. nutrient

Objective 5

47. Thrombocytes initiate blood _____.

    a. circulation

    b. clotting

    c. pressure

    d. cell division

Objective 6

48. The normal adult human body contains approximately _____ cubic centimeters of blood.

    a. 2000 to 2500

    b. 3000 to 3500

    c. 4000 to 4500

    d. 5000 to 5500

Objective 12

49. A _____ is a test that determines the percentage of red blood cells in the plasma of a total blood sample.

    a. hematocrit

    b. complete blood count

    c. red-blood-cell count

    d. platelet count

Objective 5

50. _____ are red blood cells (RBCs).

a. Leukocytes

b. Erythrocytes

c. Electrolytes

d. Lymphocytes

Objective 9

51. White blood cells _____.

a. live approximately 10 to 12 weeks

b. are colorless, irregularly shaped cells

c. are composed of about 60 to 70 percent lymphocytes

d. are composed of about 20 to 30 percent neutrophils

Objective 6

52. Blood tastes slightly _____.

a. salty and metallic

b. sweet and sugary

c. sour and stale

d. bitter and tangy

Objective 4

53. The _____ forms lymphocytes and monocytes, stores blood cells, and filters out bacteria and wornout red blood cells.

a. heart

b. thymus

c. red bone marrow

d. spleen

Objective 8

54. Which of the following statements is true of erythrocytes?

a. They are very inflexible and hard.

b. They are approximately 1/300 of an inch in diameter.

c. As mature cells, they contain no nucleus and, thus, do not grow.

d. They contain hemolysis, which is the oxygen-carrying red pigment of the red blood cell composed of iron and protein.

Objective 2

55. Which of the following are transported to and from the cells by the circulatory system?

a. oxygen and carbon dioxide

b. food and water

c. both "a" and "b"

d. neither "a" nor "b"

Answers to Module Review

1. b	12. c	23. a	34. d	45. d
2. c	13. b	24. a	35. a	46. d
3. c	14. a	25. d	36. c	47. b
4. a	15. d	26. b	37. d	48. d
5. d	16. d	27. b	38. b	49. a
6. d	17. c	28. d	39. c	50. b
7. c	18. a	29. c	40. d	51. b
8. d	19. b	30. a	41. b	52. a
9. b	20. c	31. d	42. b	53. d
10. a	21. c	32. a	43. c	54. c
11. a	22. a	33. c	44. a	55. c

MODULE SET II:
Major Body Systems

Module 8: Circulatory System—Cardiac

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Master	
1—Major Structures of the Heart	7
Written Test	9
Answers to Written Test	17
Answers to Assignment Sheet	21
Crossword Puzzles	
1—Terms from Objectives 1 and 2	23
2—Terms from Objectives 3 Through 6	25
3—Terms from Objectives 8 Through 13	27
4—Terms from Objectives 14 Through 17	29
5—Terms from Objective 17 (cont.)	31
Answers to Crossword Puzzles	33
Module Review	35
Answers to Module Review	45

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 5 of the Suggested Activities.
- Review the additional resources that follow: transparency master, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make the transparency from the transparency master.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module is the second in the series of four modules related to the circulatory system. Naturally, these modules are extensively interrelated. Review all of the modules and decide how best to present them as a series within your curriculum goals and structure. This review will also help you plan how to deal with questions that may arise during the presentations. By being familiar with the contents of all four modules and their interrelationships, you will be able to modify the lessons as you deem best for your presentation and to cross-reference the other modules when you feel that it is necessary.

- Use crossword puzzles 1 through 5 to help reinforce the terms in the associated objectives.
- For Objective 1, discuss the term *cardiovascular system.* Then, use models, illustrations, and, if permitted within your facility, animal heart-dissections to discuss the structures of the heart. Discuss the major roles of the principal structures in way of introducing later objectives.
- Continue the discussion with Objective 2 to describe the physical characteristics of the heart. Encourage the students to elaborate on these facts based on their previous studies. For example, the students should be able to locate the mediastinum, diaphragm, midline, second rib, and other anatomical references. You may wish to provide the students with an outline drawing of a human body with the skeletal structure and have the students draw the heart based on the description that you provide them. Have the students locate the septum and other structures discussed in Objective 3 on Figure 1, which is presented in Objective 9.
- To supplement Objective 4, review the types of tissues studied earlier as you discuss the tissues of the heart. Continue the discussion by relating these tissues to the covering of the heart. Use illustrations and animal hearts as required to assist the discussion.
- Without allowing the students to reference their information sheets, begin your presentation of Objective 5 through Objective 9 using Figure 1 or other suitable drawings of the heart. Point out the structures of the heart and describe their functions generally as presented. Ask the students to speculate on physiological reasons for the differences in the structures. Your discussion should lead to conclusions similar to those given in the note that accompanies item 3 in Objective 5.
- To supplement Objective 10 and Objective 11, first discuss the term *cardiopulmonary circulation* and then, using the artwork in Figure 4, help students trace the sequence of blood flow in cardiopulmonary circulation.
- To supplement Objective 12, which concerns the coronary system, explain that the myocardium cannot use the blood passing through the chambers of the heart. Therefore,

the heart needs its own circulatory system. Use the artwork in Figure 3 to illustrate the arteries and veins in the circulatory system for the heart.

- To supplement Objective 13 through Objective 16, use the artwork in Figure 4 to guide the students in learning the structures of the conduction system of the heart, the sequence for the conduction of a contraction, and the sounds of a heartbeat.

  Have the students listen to their own hearts to hear their heart sounds. Provide the class with recordings of heart sounds to help them identify the lub-dub sounds. Play recordings of abnormal heart sounds and help the class to identify the disorders indicated by the sounds.

- Discuss common disorders and abnormalities of the heart, which are presented in Objective 17. Display illustrations of damaged hearts. Discuss corrective procedures, including surgery where indicated. Invite a pharmacist to talk to the class about pharmaceutical treatments for heart conditions and the effect of various drugs on the functioning of the heart. Discuss exercise and nutrition as part of a plan to maintain a healthy heart.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites focus on the heart. Internet references in other modules concentrate on the systems specific to those modules. The web site references provided in the first module set are more general to anatomy and physiology and may also support this module.

- http://www.heartsite.com/index.html

  Although designed for patients with heart-related complaints, this site contains a great deal of information about the heart and its disorders.

- http://sln.fi.edu/biosci/biosci.html

  This site allows students to explore the heart, its structure and development, the flow of blood, and its relationship to other body systems. The site also presents information about heart health and the history of heart science.

- http://www.stayhealthy.com/centers/diseasesconditions2.cfm?P=175

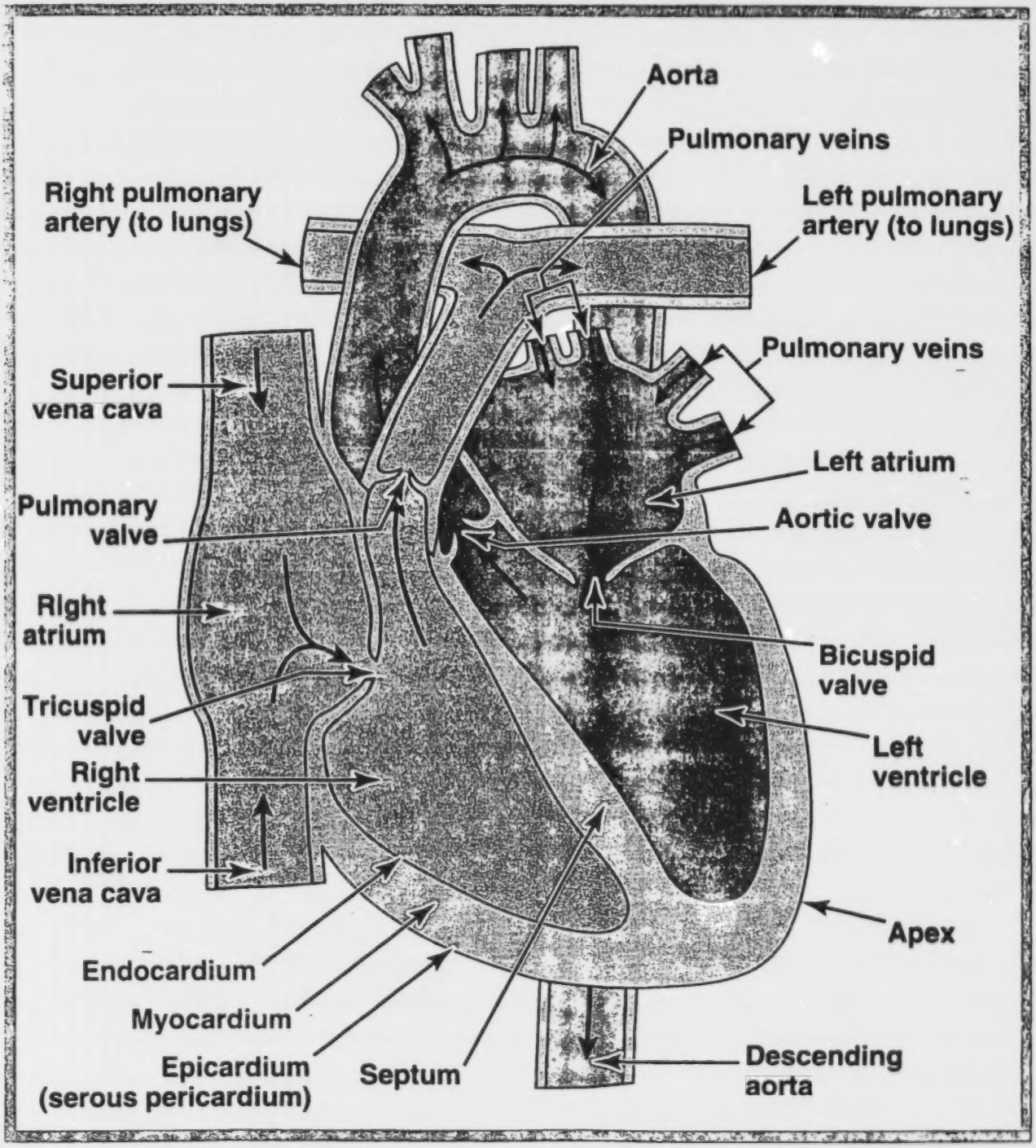
  This site provides links to other sites that provide information about heart health.

- http://www.americanheart.org/

  This is the American Heart Association's site. It offers several interactive pages and lots of good information.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

Major Structures of the Heart



Written Test

Name _____

Date _____ Score _____

OBJECTIVE 1

Define the term *cardiovascular system*. Write your answer on the blank lines provided beside the term below.

Cardiovascular system _____

_____

OBJECTIVE 2

Complete statements that describe the size and position of the heart. Write your answers on the blank lines provided in the statements below.

a. The heart is a hollow, muscular organ that is about the size and shape of a person's fist and weighs _____ to _____ grams.

b. The heart is suspended in the thoracic cavity by vessels and lies in the _____ with approximately two-thirds of its mass to the left of the midline of the body.

c. The heart rests obliquely in the body with the _____ side anterior to the _____ side; it rests on the _____ with the apex pointing left and is positioned with the base below the _____ rib.

d. The heart lies in a fibrous, loose-fitting sac called the _____, which consists of the serous pericardium and the fibrous pericardium.

e. The serous pericardium consists of a _____ layer, which lines the inside of the fibrous pericardium, and a _____ layer, which adheres to the surface of the heart.

f. Between the two layers of the pericardium is the pericardial space, which contains the _____ that lubricates the opposing surfaces of the space and allows the heart to move easily during contraction.

Objective 3 List the major structures of the heart. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

Objective 4 Define the tissue layers of the heart. Write your answers on the blank lines provided beside each of the terms below.

a. Endocardium _____

_____

b. Myocardium _____

_____

c. Epicardium _____

_____

Objective 5 Complete statements that describe the characteristics of the chambers of the heart. Write your answers on the blank lines provided in the statements below.

a. The heart is divided into four chambers: (1) the _____, (2) the _____, (3) the _____, and (4) the _____.

b. The two upper chambers—the _____—collect blood; the _____ receives deoxygenated blood and the _____ receives oxygenated blood.

c. The two lower chambers—the _____—pump blood from the heart; the _____ pumps deoxygenated blood to the lungs and the _____ pumps oxygenated blood to the body.

d. Because they do the pumping, the _____ consist of thicker muscle tissue than the _____, and the _____, which pumps blood to the body, is approximately three times thicker than the _____.

Objective 6

Complete statements that describe the characteristics of the major veins of the heart. Write your answers on the blank lines provided in the statements below.

a. Deoxygenated blood returns to the heart from the body by the way of two large veins—the _____ vena cava and the _____ vena cava.

b. The _____ vena cava carries blood from the upper part of the body.

c. The _____ vena cava carries blood from the lower part of the body.

d. The _____ and _____ venae cavae deposit deoxygenated blood into the right _____.

e. The right and left _____ veins carry oxygenated blood back to the heart from the lungs.

f. The _____ veins deposit oxygenated blood in the left _____.

Objective 7

Complete statements that describe the characteristics of the major arteries of the heart. Write your answers on the blank lines provided in the statements below.

a. When the heart contracts, blood leaves the _____ ventricle of the heart through the _____ pulmonary artery and the _____ pulmonary artery and travels to the lungs.

b. When the heart contracts, oxygenated blood leaves the _____ ventricle through the _____, the largest artery of the body.

c. The _____ branches into smaller _____ that carry blood to all the parts of the body.

Objective 8

Complete statements that describe the characteristics of the major valves of the heart. Write your answers on the blank lines provided in the statements below and on the next page.

a. There are four major valves in the heart: (1) the _____ valve, (2) the _____ valve, (3) the _____ valve, and (4) the _____ valve.

b. The _____ valve is located between the right atrium and the right ventricle and consists of three main cusps (flaps).

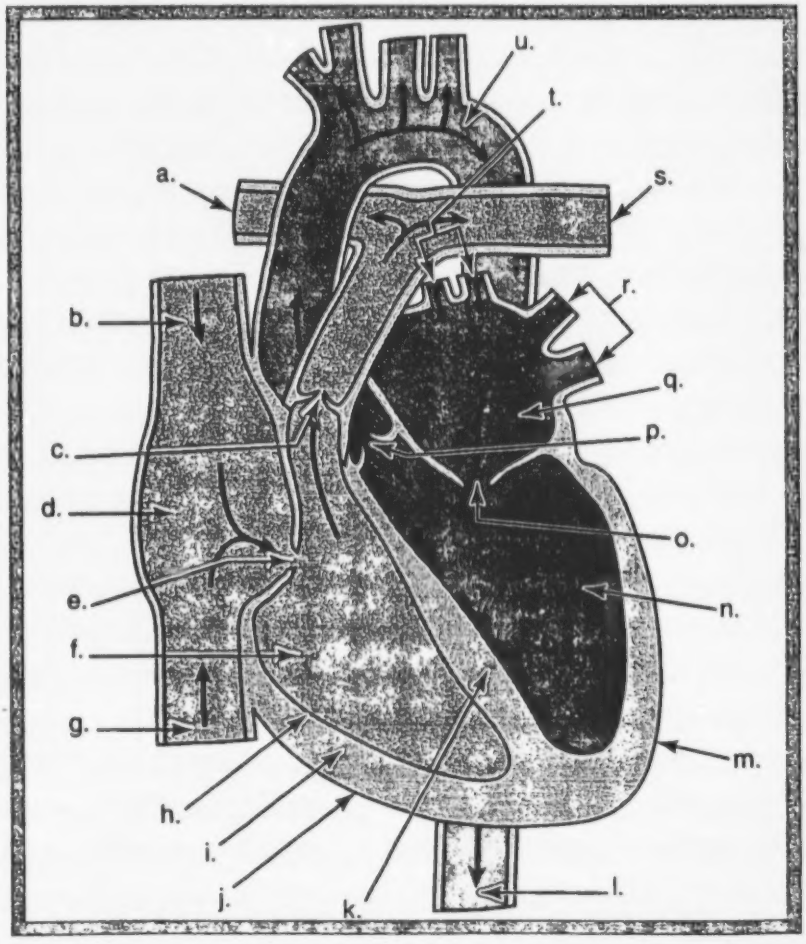
c. The _____ valve, which is also called the _____ *valve*, is located between the left atrium and the left ventricle and consists of two cusps.

d. The _____ valve, which is also called the _____ *valve*, is located in the pulmonary artery and consists of three semilunar cusps that prevent blood from flowing back into the right ventricle from the pulmonary artery.

e. The _____ valve, which is also called the _____ *valve*, is located between the left ventricle and the aorta and consists of three semilunar cusps that prevent blood from flowing back into the left ventricle from the aorta.

OBJECTIVE 9

Label the major structures of the heart. Write your answers on the blank lines provided on the page following the illustration below.



a. _____ l. _____

b. _____ m. _____

c. _____ n. _____

d. _____ o. _____

e. _____ p. _____

f. _____ q. _____

g. _____ r. _____

h. _____ s. _____

i. _____ t. _____

j. _____ u. _____

k. _____

OBJECTIVE 10 Define the term *cardiopulmonary circulation*. Write your answer on the blank lines provided beside the term below.

Cardiopulmonary circulation _____

_____

OBJECTIVE 11 Arrange in order the sequence of blood flow in cardiopulmonary circulation. Write the numbers 1 through 13 on the blanks provided.

_____ a. Pulmonary artery

_____ b. Bicuspid valve

_____ c. Tricuspid valve

_____ d. Aorta

_____ e. Pulmonary valve

_____ f. Left ventricle

_____ g. Right atrium

_____ h. Right ventricle

_____ i. Pulmonary veins

_____ j. Vena cava

_____ k. Aortic valve

_____ l. Lungs

_____ m. Left atrium

OBJECTIVE 12 Complete statements that describe the characteristics of the coronary arteries and veins. Write your answers on the blank lines provided in the statements below.

a. Blood passing through the chambers of the heart cannot be used by the _____.

b. A _____, consisting of coronary arteries and coronary veins, provides the circulatory system for the heart.

c. Two coronary arteries branch from the aorta and supply the heart; the _____ coronary artery supplies the right side of the heart and the _____ coronary artery supplies the left side of the heart.

d. The coronary veins drain blood from the capillary beds of the _____ and into the _____ atrium of the heart.

OBJECTIVE 13 Define the term *conduction system of the heart.* Write your answer on the blank lines provided beside the term below.

Conduction system of the heart _____

_____

_____

_____

OBJECTIVE 14 Define the major structures of the conduction system of the heart. Write your answers on the blank lines provided beside each of the terms below.

a. Sinoatrial node _____

_____

b. Atrioventricular node _____

_____

c. Bundle of His _____

_____

d. Purkinje fibers _____

_____

Objective 15 State the sequence for the conduction of a contraction of the heart in a heartbeat. Write your answers on the blank lines provided below.

a. _____

_____

b. _____

_____

c. _____

_____

Objective 16 Define the sounds of a heartbeat. Write your answers on the blank lines provided beside each of the terms below.

a. Lub _____

_____

b. Dub _____

_____

Objective 17 Match common disorders and abnormalities of the heart to their correct definitions. Write the numbers on the blanks provided below. Terms and definitions continue on the next page.

_____ a. A common arterial disorder characterized by yellowish plaque and other materials along the walls of large- and medium-sized arteries, causing the vessels to narrow and reducing blood flow to the organs normally supplied by the arteries

_____ b. Severe chest pain caused by oxygen deprivation to the myocardium as a result of atherosclerosis of the coronary arteries

_____ c. An inability of the left ventricle to pump adequately, resulting in failure of the ventricle to eject blood efficiently, causing volume overload, chamber dilatation, and elevated intracardiac pressure

_____ d. Any irregular rhythm of the heart

_____ e. Any one of the abnormal conditions that may affect the arteries of the heart and produce various pathologic effects, especially the reduced flow of oxygen and nutrients to the myocardium

_____ f. An abnormally slow heart rate generally defined as less than 60 beats per minute at rest

1. Angina pectoris
2. Arrhythmia
3. Atherosclerosis
4. Bradycardia
5. Congestive heart failure (CHF)
6. Coronary-artery disease

_____ g. A very rapid, regular heartbeat that may interfere with normal function

_____ h. A condition characterized by leakage in the bicuspid valve due to its abnormal extension into the left atrium

_____ i. A failure of ventricle pumping action characterized by a complete lack of organized electric impulse, conduction, and ventricular contraction

_____ j. The death of heart-muscle tissue that is often due to an obstruction of the coronary artery

_____ k. Congested pulmonary circulation caused most commonly by congestive heart failure

_____ l. A narrowing of the heart valves

_____ m. A pounding or racing of the heart that is associated with normal emotional responses or with heart disorders

_____ n. An abnormally fast heart rate generally defined as more than 100 beats per minute at rest

_____ o. Damage to heart muscle and heart valves caused by rheumatic fever, a streptococcal infection, which may result in permanent deformities of the heart

7. Flutter
8. Mitral-valve prolapse (MVP)
9. Myocardial infarction (MI)
10. Palpitation
11. Pulmonary edema
12. Rheumatic heart disease
13. Stenosis
14. Tachycardia
15. Ventricular fibrillation

Answers to Written Test

Objective 1

The network of anatomical structures, including the heart and the blood vessels, that pump blood throughout the body

Objective 2

a. 250; 350
b. mediastinum
c. right; left; diaphragm; second
d. pericardium
e. parietal; visceral
f. pericardial fluid

Objective 3

Answers may appear in any order.

a. Septum
b. Chambers
c. Veins
d. Arteries
e. Valves

Objective 4

a. The innermost serous membrane that lines the chambers of the heart and its valves

b. The middle layer of heart tissue that consists of cardiac muscle that contracts to provide the pumping action of the heart

c. The outer serous membrane of the heart

Objective 5

a. right atrium; right ventricle; left atrium; left ventricle
b. atria; right atrium; left atrium
c. ventricles; right ventricle; left ventricle
d. ventricles; atria; left ventricle; right ventricle

Objective 6

a. superior; inferior
b. superior
c. inferior
d. superior; inferior; atrium
e. pulmonary
f. pulmonary; atrium

Objective 7

a. right; left; right
b. left; aorta
c. aorta; arteries

Objective 8

a. tricuspid; bicuspid; pulmonary; aortic
b. tricuspid
c. bicuspid; mitral
d. pulmonary; pulmonary semilunar
e. aortic; aortic semilunar

Objective 9

a. Right pulmonary artery
b. Superior vena cava
c. Pulmonary valve
d. Right atrium
e. Tricuspid valve
f. Right ventricle
g. Inferior vena cava
h. Endocardium
i. Myocardium
j. Epicardium (serous pericardium)
k. Septum
l. Descending aorta
m. Apex
n. Left ventricle
o. Bicuspid valve
p. Aortic valve
q. Left atrium
r. Pulmonary veins
s. Left pulmonary artery
t. Pulmonary veins
u. Aorta

Objective 10

The circulation of blood from the right ventricle of the heart to the lungs and back to the left atrium of the heart

Objective 11

a. 6	d. 13	g. 2	j. 1	m. 9
b. 10	e. 5	h. 4	k. 12	
c. 3	f. 11	i. 8	l. 7	

Objective 12

a. myocardium
b. coronary system
c. right; left
d. myocardium; right

Objective 13

The network of nervous tissue that transmits the electrical impulses needed for a heartbeat

Objective 14

a. The cluster of cells located in the right atrium near the opening of the superior vena cava and consisting of a knot of modified heart muscle that generates electrical impulses throughout the muscle fibers of both atria, causing them to contract

b. The cluster of cells located at the base of the right atrium that receives the electrical impulse from the sinoatrial node and conducts it to the atrioventricular bundle of His and then to the walls of the ventricles

c. A band of cardiac muscle fiber that arises from the distal portion of the AV node and extends across the septum, where it divides into the left and right bundle branches

d. The myocardial fibers that are a continuation of the bundle branches and extend into the muscle walls of the ventricles

Objective 15

Answers **must** appear in this order.

a. Each electrical impulse discharged by the SA node is transmitted to the AV node, causing the atria to contract.
b. From the AV node, the electrical impulses are conducted to the bundle of His and its right and left branches.
c. From the branches of the bundle of His, the electrical impulses are conducted to the Purkinje fibers, which extend into the walls of the ventricles, causing them to contract.

Objective 16

a. The longer, louder portion of a heartbeat that is produced by the closing of the atrioventricular valves (tricuspid valve and bicuspid valve) during contraction

b. The shorter, softer portion of a heartbeat that is produced by the closing of the semilunar valves (pulmonary valve and aortic valve)

Objective 17

a. 3	d. 2	g. 7	j. 9	m. 10
b. 1	e. 6	h. 8	k. 11	n. 14
c. 5	f. 4	i. 15	l. 13	o. 12

Answers to Assignment Sheet

Assignment Sheet 1

Answers to the investigation points should include the following.

INVESTIGATION POINT 1

The SA node generates an impulse without intervention of the brain. The impulse causes the atria to contract. The SA responds to nervous and hormonal conditions to regulate the heartbeat. Its advantages are that it is the natural, most versatile, and most efficient means of regulating heartbeat. Its disadvantage is that it can fail, though it is remarkably dependable.

INVESTIGATION POINT 2

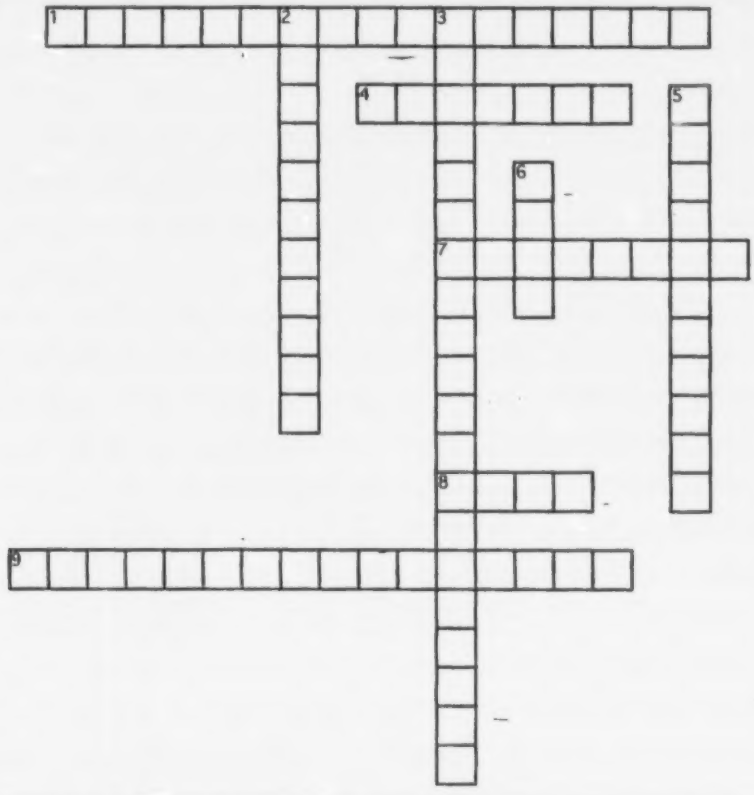
Ectopic pacemakers are cells in the heart tissue, such as the atrioventricular node or the Purkinje fibers that take over the functions of the SA node and provide basically the same function. They offer no real advantage over the SA node but are superior to artificial pacemakers in that they do regulate heartbeat in accordance with the body's demands. Their disadvantage is that they are a backup system and are not quite as efficient as the SA node and have fewer backups once engaged.

INVESTIGATION POINT 3

An artificial pacemaker is an electronic device implanted in the body to perform the functions of a failed SA node. Though designs vary, artificial pacemakers use an electrode threaded into the right ventricle to provide an electrical stimulus to produce heart contraction. Their advantage is that they allow a person to continue living when natural systems have failed. Their disadvantage is that they are artificial and require maintenance (such as battery replacement) and provide a steady "average" heartbeat without adjusting to the demands of the body.

Crossword Puzzle 1—Terms from Objectives 1 and 2

Name _____ Date _____



ACROSS

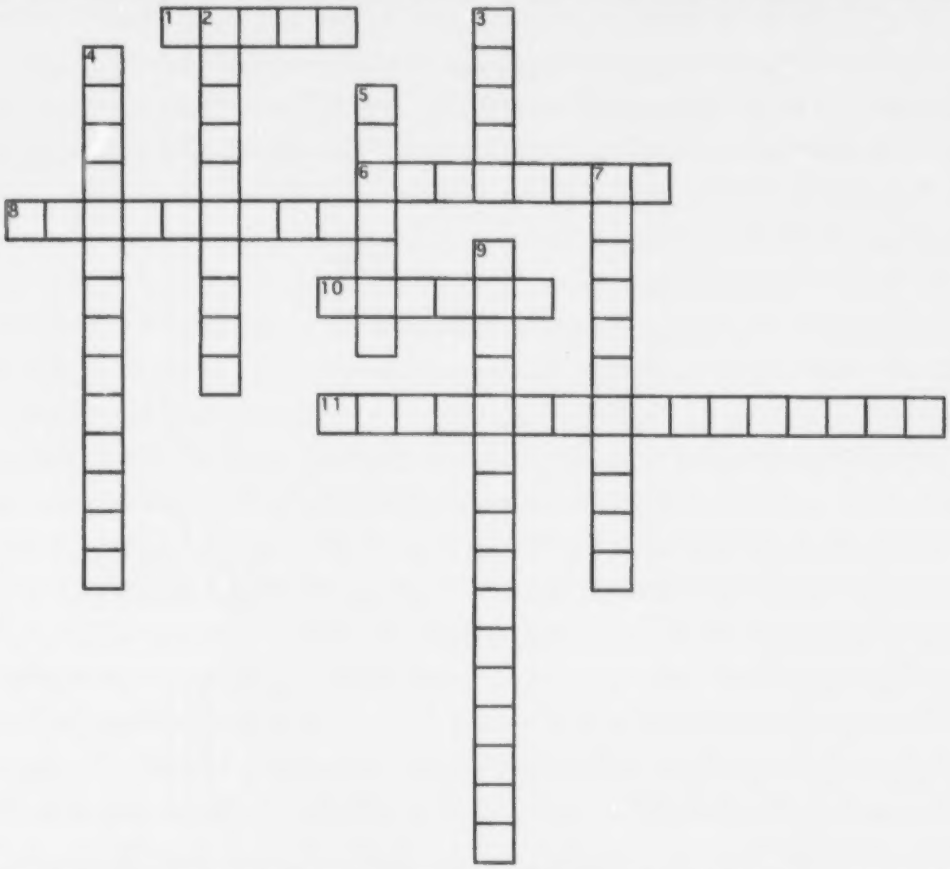
1. The structure of the heart that consists of a parietal layer, which lines the inside of the fibrous pericardium, and a visceral layer, which adheres to the surface of the heart (2 words)
4. Of or pertaining to the heart
7. Of or pertaining to the blood vessels
8. The lower border of the heart
9. The structure of the heart that is located between the two layers of the pericardium and contains the pericardial fluid that lubricates the opposing surfaces of the space and allows the heart to move easily during contraction (2 words)

DOWN

2. A fibrous, loose-fitting sac that contains the heart; it consists of the serous pericardium and the fibrous pericardium
3. The network of anatomical structures, including the heart and the blood vessels, that pump blood throughout the body (2 words)
5. A portion of the thoracic cavity in the middle of the thorax, between the pleural sacs containing the two lungs
6. The upper border of the heart

Crossword Puzzle 2—Terms from Objectives 3 Through 6

Name _____ Date _____



ACROSS

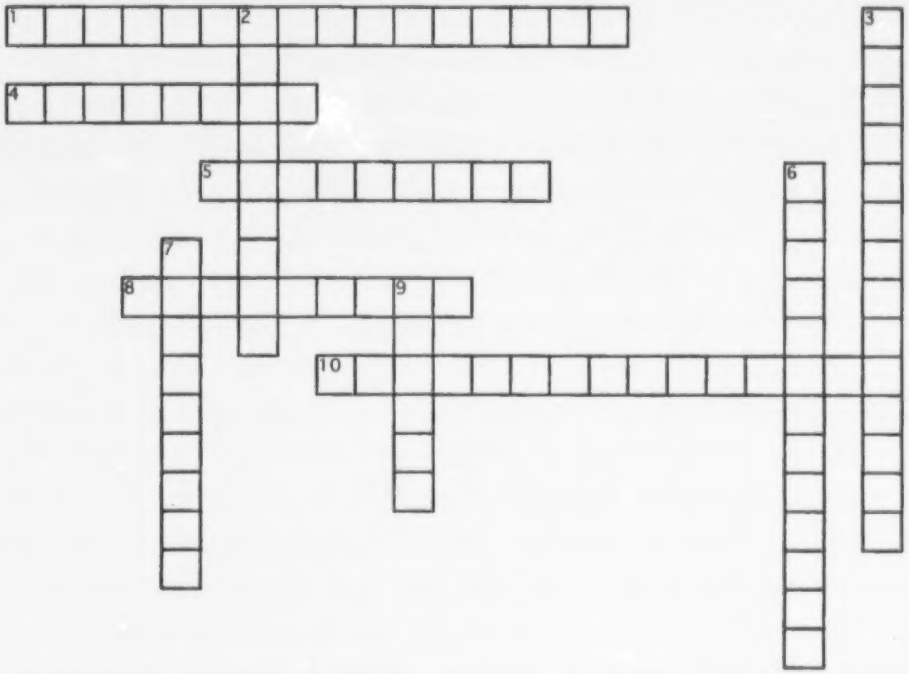
1. Blood vessels that convey blood to the heart
6. Blood vessels that carry blood from the heart
8. The middle layer of heart tissue that consists of cardiac muscle that contracts to provide the pumping action of the heart
10. The partition or wall that divides the heart into right and left halves
11. A large vein that returns deoxygenated blood to the right atrium of the heart from the lower part of the body (3 words)

DOWN

2. The outer serous membrane of the heart
3. A structure in a vessel that prevents the backflow of blood
4. Blood vessels that carry oxygenated blood back to the left atrium of the heart from the lungs (2 words)
5. A hollow but not necessarily empty space or cavity in an organ
7. The innermost serous membrane that lines the chambers of the heart and its valves
9. A large vein that returns deoxygenated blood to the right atrium of the heart from the upper part of the body (3 words)

Crossword Puzzle 3—Terms from Objectives 8 Through 13

Name _____ Date _____



ACROSS

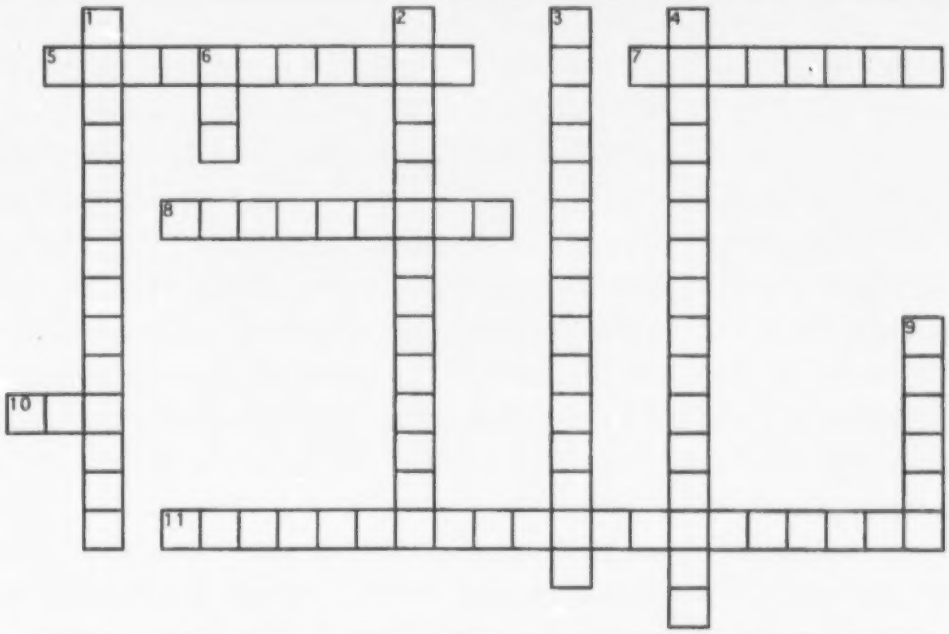
1. The network of nervous tissue that transmits the electrical impulses needed for a heartbeat is the _____ of the heart (2 words)
4. The _____ valve is the major heart valve that is located between the left atrium and the left ventricle and consists of two cusps; also called the *mitral valve*
5. The _____ valve is the major heart valve that is located in the pulmonary artery and consists of three semilunar cusps that prevent blood from flowing back into the right ventricle from the pulmonary artery; also called the *pulmonary semilunar valve*
8. Half-moon shaped
10. _____ circulation is the circulation of blood from the right ventricle of the heart to the lungs and back to the left atrium of the heart

DOWN

2. The _____ valve is the major heart valve that is located between the right atrium and the right ventricle and consists of three main cusps (flaps)
3. The _____ provides the circulatory system for the heart and consists of coronary arteries and coronary veins (2 words)
6. The _____ drain blood from the capillary beds of the myocardium and into the right atrium of the heart (2 words)
7. One complete pulsation of the heart
9. The _____ valve is the major heart valve that is located between the left ventricle and the aorta and consists of three semilunar cusps that prevent blood from flowing back into the left ventricle from the aorta; also called the *aortic semilunar valve*

Crossword Puzzle 4—Terms from Objectives 14 Through 17

Name _____ Date _____



ACROSS

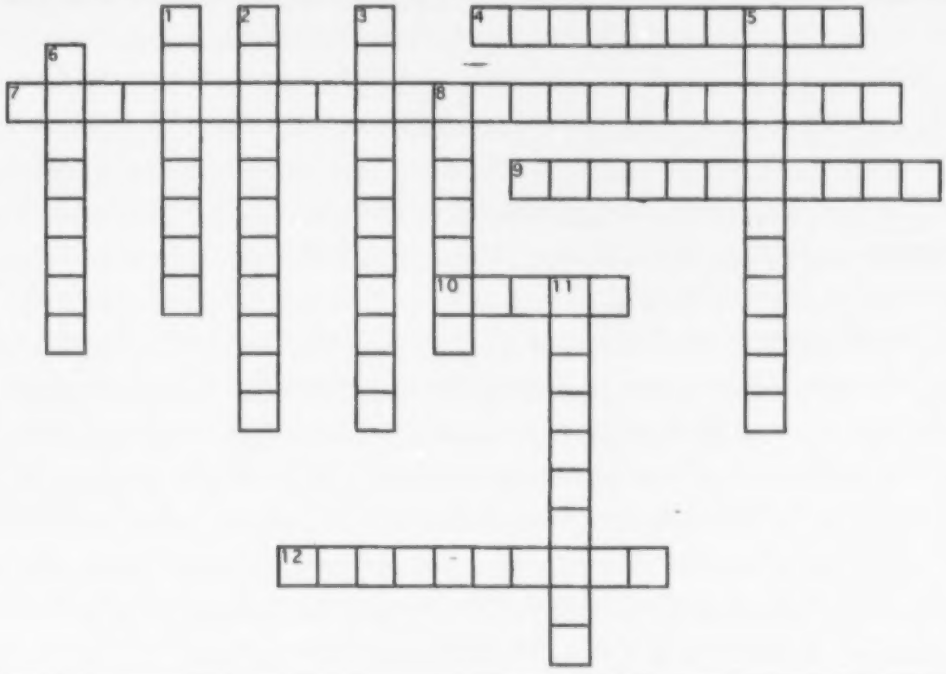
5. A band of cardiac muscle fiber that arises from the distal portion of the AV node and extends across the septum, where it divides into the left and right bundle branches (3 words)
7. A narrowing of the heart valves
8. Damage to heart muscle and heart valves caused by rheumatic fever, a streptococcal infection, which may result in permanent deformities of the heart is called _____ *heart disease*
10. The shorter, softer portion of a heartbeat that is produced by the closing of the semilunar valves (pulmonary valve and aortic valve)
11. The cluster of cells located at the base of the right atrium that receives the electrical impulse from the sinoatrial node and conducts it to the atrioventricular bundle of His and then to the walls of the ventricles (2 words)

DOWN

1. The myocardial fibers that are a continuation of the bundle branches and extend into the muscle walls of the ventricles (2 words)
2. The cluster of cells located in the right atrium near the opening of the superior vena cava and consisting of a knot of modified heart muscle that generates electrical impulses throughout the muscle fibers of both atria, causing them to contract (2 words)
3. A common arterial disorder characterized by yellowish plaque and other materials along the walls of large- and medium-sized arteries, causing the vessels to narrow and reducing blood flow to the organs normally supplied by the arteries
4. Of, relating to, or located between an atrium and ventricle of the heart
6. The longer, louder portion of a heartbeat that is produced by the closing of the atrioventricular valves (tricuspid valve and bicuspid valve) during contraction
9. A localized abnormal patch on a body part or surface

Crossword Puzzle 5—Terms from Objective 17 (cont.)

Name _____ Date _____



ACROSS

4. Any irregular rhythm of the heart
7. A failure of ventricle pumping action characterized by a complete lack of organized electric impulse, conduction, and ventricular contraction (2 words)
9. A pounding or racing of the heart that is associated with normal emotional responses or with heart disorders
10. Congested pulmonary circulation caused most commonly by congestive heart failure is called *pulmonary* _____
12. An inability of the left ventricle to pump adequately, resulting in failure of the ventricle to eject blood efficiently, causing volume overload, chamber dilatation, and elevated intracardiac pressure is called _____ *heart failure*

DOWN

1. Any one of the abnormal conditions that may affect the arteries of the heart and produce various pathologic effects, especially the reduced flow of oxygen and nutrients to the myocardium is called _____*-artery disease*
2. An abnormally fast heart rate generally defined as more than 100 beats per minute at rest
3. An abnormally slow heart rate generally defined as less than 60 beats per minute at rest
5. _____ prolapse is a condition characterized by leakage in the bicuspid valve due to its abnormal extension into the left atrium (2 words)
6. Angina _____ is severe chest pain caused by oxygen deprivation to the myocardium as a result of atherosclerosis of the coronary arteries
8. A very rapid, regular heartbeat that may interfere with normal function
11. _____ infarction is the death of heart-muscle tissue that is often due to an obstruction of the coronary artery

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. SEROUS PERICARDIUM
4. CARDIAC
7. VASCULAR
8. APEX
9. PERICARDIAL SPACE

DOWN
2. PERICARDIUM
3. CARDIOVASCULAR SYSTEM
5. MEDIASTINUM
6. BASE

Crossword Puzzle 2

ACROSS
1. VEINS
6. ARTERIES
8. MYOCARDIUM
10. SEPTUM
11. INFERIOR VENA CAVA

DOWN
2. EPICARDIUM
3. VALVE
4. PULMONARY VEINS
5. CHAMBER
7. ENDOCARDIUM
9. SUPERIOR VENA CAVA

Crossword Puzzle 3

ACROSS
1. CONDUCTION SYSTEM
4. BICUSPID
5. PULMONARY
8. SEMILUNAR
10. CARDIOPULMONARY

DOWN
2. TRICUSPID
3. CORONARY SYSTEM
6. CORONARY VEINS
7. HEARTBEAT
9. AORTIC

Crossword Puzzle 4

ACROSS
5. BUNDLE OF HIS
7. STENOSIS
8. RHEUMATIC
10. DUB
11. ATRIOVENTRICULAR NODE

DOWN
1. PURKINJE FIBERS
2. SINOATRIAL NODE
3. ATHEROSCLEROSIS
4. ATRIOVENTRICULAR
6. LUB
9. PLAQUE

Crossword Puzzle 5

ACROSS

4. ARRHYTHMIA
7. VENTRICULAR FIBRILLATION
9. PALPITATION
10. EDEMA
12. CONGESTIVE

DOWN

1. CORONARY
2. TACHYCARDIA
3. BRADYCARDIA
5. MITRAL VALVE
6. PECTORIS
8. FLUTTER
11. MYOCARDIAL

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 10

1. The circulation of blood from the right ventricle of the heart to the lungs and back to the left atrium of the heart is called _____.

   a. *cardiac circulation*

   b. *vascular circulation*

   c. *cardiovascular circulation*

   d. *cardiopulmonary circulation*

Objective 12

2. Two _____ branch from the aorta to supply blood to the heart.

   a. coronary arteries

   b. coronary veins

   c. pulmonary arteries

   d. pulmonary veins

Objective 17

3. _____ is a very rapid, regular heartbeat that may interfere with normal function.

   a. Congestive heart failure

   b. Myocardial infarction

   c. Ventricular fibrillation

   d. Flutter

Objective 17

4. Rheumatic heart disease is damage to heart tissues and valves caused by _____.

   a. streptococcal infection

   b. excessive exercise and strain

   c. smoking

   d. toxins in the blood

Objective 9

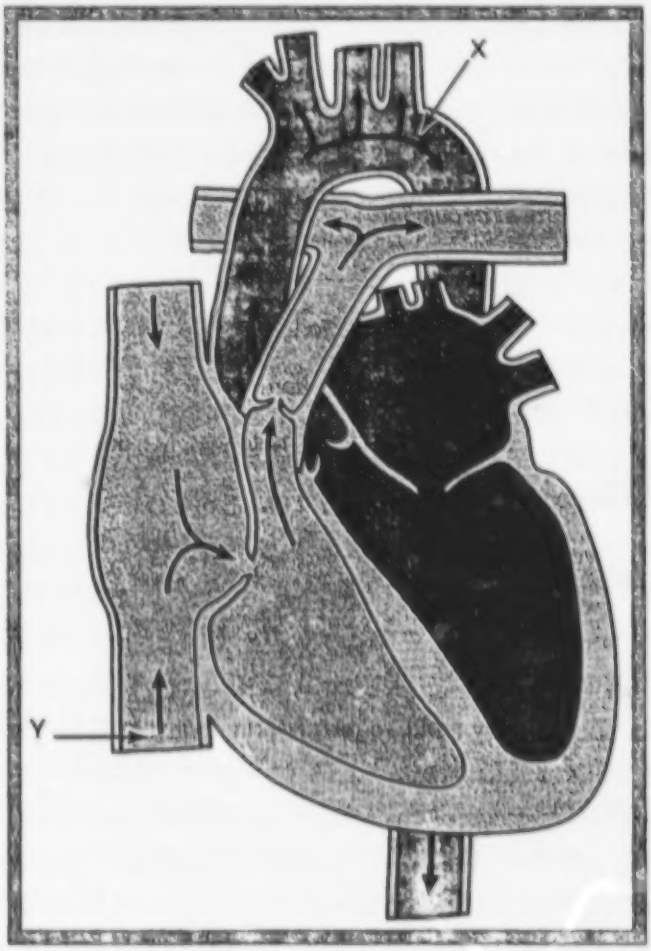
5. What major structure of the heart is indicated by the letter "X" in the illustration below?

   a. aorta

   b. left pulmonary artery

   c. superior vena cava

   d. inferior vena cava



Objective 9

6. What major structure of the heart is indicated by the letter "Y" in the illustration above?

   a. aorta

   b. left pulmonary artery

   c. superior vena cava

   d. inferior vena cava

Objective 14

7. The band of cardiac muscle fiber that arises from the distal portion of the AV node and extends across the septum, where it divides into left and right branches is the _____.

   a. sinoatrial node
   b. atrioventricular node
   c. bundle of His
   d. Purkinje fibers

Objective 17

8. Severe chest pain caused by oxygen deprivation to the myocardium as a result of atherosclerosis is _____.

   a. pulmonary edema
   b. mitral-valve prolapse
   c. myocardial infarction
   d. angina pectoris

Objective 4

9. The _____ lines the chambers and valves of the heart.

   a. endocardium
   b. myocardium
   c. pericardium
   d. septum

Objective 12

10. The _____ drain blood from the capillary beds of the myocardium of the heart and into the right atrium of the heart.

   a. coronary arteries
   b. coronary veins
   c. pulmonary arteries
   d. pulmonary veins

Objective 17

11. The accumulation of plaque and other materials along the walls of arteries that can cause the vessels to narrow, is referred to as _____.

   a. *atherosclerosis*
   b. *pulmonary edema*
   c. *angina pectoris*
   d. *osteoporosis*

Objective 9

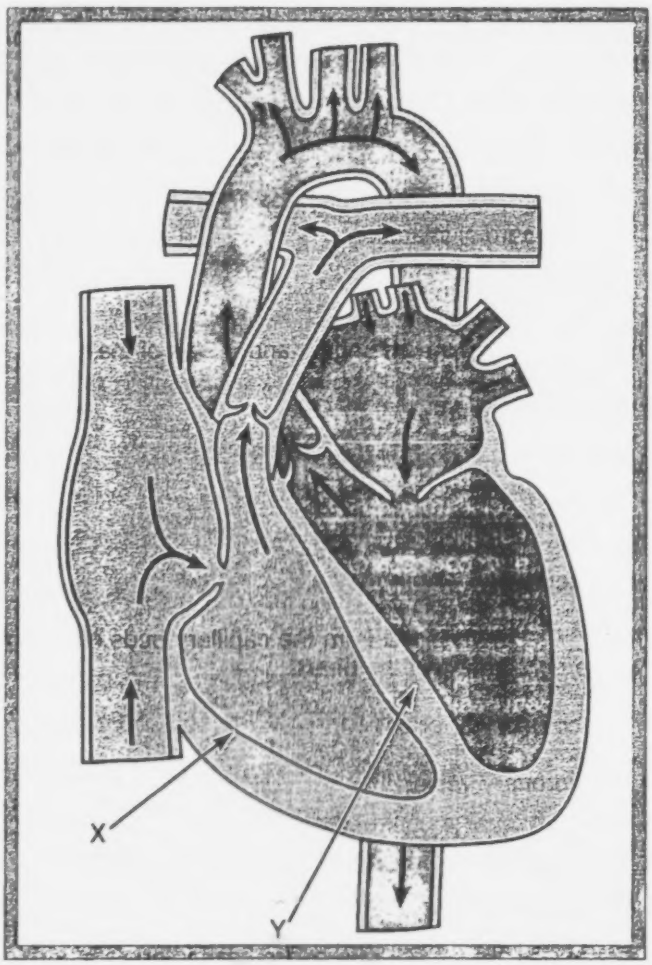
12. What tissue layer of the heart is indicated by the letter "X" in the illustration below?

    a. endocardium

    b. myocardium

    c. epicardium

    d. right ventricle



Objective 9

13. What major structure of the heart is indicated by the letter "Y" in the illustration above?

    a. endocardium

    b. myocardium

    c. septum

    d. right ventricle

Objective 8

14. The _____ valve consists of three flaps or cusps.

    a. aortic semilunar valve

    b. pulmonary semilunar valve

    c. bicuspid valve

    d. tricuspid valve

Objective 17

15. The death of heart-muscle tissue that is often caused by an obstruction of the coronary artery is _____.

    a. pulmonary edema

    b. mitral-valve prolapse

    c. myocardial infarction

    d. angina pectoris

Objective 6

16. The superior vena cava _____.

    a. carries blood from the lower part of the body

    b. carries blood from the upper part of the body

    c. carries oxygenated blood back to the heart from the lungs

    d. deposits oxygenated blood in the left ventricle

Objective 8

17. The semilunar valves are shaped like a _____.

    a. square

    b. triangle

    c. circle

    d. half-moon

Objective 2

18. Which of the following statements is NOT true about the positioning of the heart?

    a. It lies in the mediastinum with approximately two-thirds of its mass to the left of the midline of the body.

    b. It rests obliquely in the body with the right side anterior to the left side.

    c. It rests on the liver with the apex pointing left.

    d. It is positioned with the base below the second rib.

Objective 9

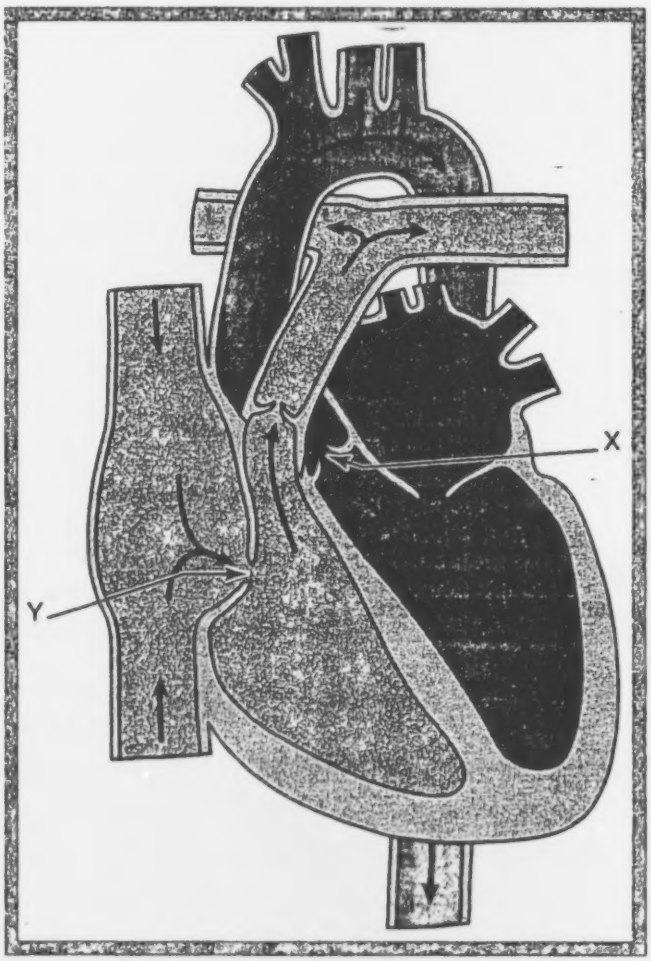
19. What major structure of the heart is indicated by the letter "X" in the illustration below?

a. aortic valve

b. bicuspid valve

c. tricuspid valve

d. pulmonary valve



Objective 9

20. What major structure of the heart is indicated by the letter "Y" in the illustration above?

a. aortic valve

b. bicuspid valve

c. tricuspid valve

d. pulmonary valve

Objective 3

21. The heart is divided into left and right halves by the _____.

    a. endocardium
    b. myocardium
    c. pericardium
    d. septum

Objective 5

22. The left ventricle _____.

    a. receives deoxygenated blood
    b. receives oxygenated blood
    c. pumps deoxygenated blood to the lungs
    d. pumps oxygenated blood to the body

Objective 5

23. The right atrium _____.

    a. receives deoxygenated blood
    b. receives oxygenated blood
    c. pumps deoxygenated blood to the lungs
    d. pumps oxygenated blood to the body

Objective 1

24. The network of anatomical structures, including the heart and the blood vessels, that pump blood throughout the body is the _____.

    a. cardiac system
    b. vascular system
    c. cardiovascular system
    d. mediastinum

Objective 11

25. Which of the following lists a correct sequence of blood flowing in cardiopulmonary circulation?

    a. vena cava, tricuspid valve, right atrium
    b. right ventricle, pulmonary artery, pulmonary valve
    c. lungs, pulmonary veins, left atrium
    d. bicuspid valve, aorta, aortic valve

Objective 17

26. _____ is a failure of ventricle pumping action.

a. Ventricular fibrillation

b. Mitral-valve prolapse

c. Myocardial infarction

d. none of the above

Objective 2

27. The heart weighs approximately _____ grams.

a. 100 to 200

b. 250 to 350

c. 400 to 500

d. 550 to 650

Objective 7

28. When the heart contracts, blood leaves the right ventricle of the heart through the _____ and the _____ and travels to the lungs.

a. superior vena cava; inferior vena cava

b. right atrium; left atrium

c. left pulmonary artery; right pulmonary artery

d. left ventricle; aorta

Objective 13

29. The conduction system of the heart is the network of _____ tissue that transmits the electrical impulses needed for a heartbeat.

a. serous

b. muscular

c. nervous

d. cardiovascular

Objective 4

30. The epicardium is a _____ membrane.

a. visceral

b. temporary

c. mucous

d. serous

Objective 15

31. Which of the following is the correct sequence for the conduction of a contraction of the heart in a heartbeat?

    a. SA node → AV node → bundle of His → Purkinje fibers

    b. AV node → SA node → bundle of His → Purkinje fibers

    c. SA node → AV node → Purkinje fibers → bundle of His

    d. Purkinje fibers → bundle of His → AV node → SA node

Objective 16

32. Which of the following is NOT a correct statement about the sounds of a heartbeat?

    a. The longer, louder portion of a heartbeat is the "dub" sound.

    b. The longer, louder portion of a heartbeat is produced by the closing of the atrioventricular valves.

    c. The shorter, softer portion of a heartbeat is the "dub" sound.

    d. The shorter, softer portion of a heartbeat is produced by the closing of the semilunar valves.

Objective 8

33. Which of the following statements is NOT true about the bicuspid valve?

    a. It is located between the two left chambers.

    b. It consists of two flaps or cusps.

    c. It has valve flaps that prevent blood from flowing back into the right ventricle.

    d. It is located between the left atrium and the left ventricle.

Objective 17

34. Bradycardia is an abnormal heart rate generally defined as _____ beats per minute at rest.

    a. less than 60

    b. more than 60

    c. less than 100

    d. more than 100

Objective 2

35. The heart is suspended in the thoracic cavity by _____.

    a. vessels

    b. ligaments

    c. tendons

    d. pericardium

Objective 17

36. Any irregular rhythm of the heart is _____.

    a. stenosis
    b. tachycardia
    c. arrhythmia
    d. palpitation

Objective 12

37. A coronary system, consisting of coronary arteries and coronary veins, supplies blood to the _____.

    a. myocardium
    b. inferior vena cava
    c. superior vena cava
    d. lungs

Objective 2

38. The heart lies in a fibrous, loose-fitting sac called the _____.

    a. *pericardium*
    b. *parietal pericardium*
    c. *pericardial space*
    d. none of the above

Objective 6

39. The right pulmonary vein _____.

    a. carries blood from the lower part of the body
    b. carries blood from the upper part of the body
    c. carries oxygenated blood back to the heart from the lungs
    d. deposits deoxygenated blood in the left ventricle

Objective 4

40. The _____ consists of cardiac muscle tissue that contracts to provide the pumping action of the heart.

    a. endocardium
    b. myocardium
    c. pericardium
    d. septum

Answers to Module Review

1. d	9. a	17. d	25. c	33. c
2. a	10. b	18. c	26. a	34. a
3. d	11. a	19. a	27. b	35. a
4. a	12. a	20. c	28. c	36. c
5. a	13. c	21. d	29. c	37. a
6. d	14. d	22. d	30. d	38. a
7. c	15. c	23. a	31. a	39. c
8. d	16. b	24. c	32. a	40. b

MODULE SET II:
Major Body Systems

Module 9: Circulatory System—Vascular

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Sequence of Blood Circulation Through the Systemic Circulation System	7
2—The Tissue Layers of an Artery	9
3—Major Arteries of the Systemic Circulation System	11
4—The Tissue Layers of a Vein	13
5—Major Veins of the Systemic Circulation System	15
6—Major Structures of the Portal Circulation System	17
7—Common Pulse Points	19
Written Test	21
Answers to Written Test	41
Answers to Assignment Sheet	49
Crossword Puzzles	
1—Terms from Objectives 1 Through 5	51
2—Terms from Objectives 7 and 8	53
3—Terms from Objective 9	55
4—Terms from Objective 9 (cont.)	57
5—Terms from Objective 9 (cont.)	59
6—Terms from Objective 9 (cont.)	61
7—Terms from Objectives 11 Through 15	63
8—Terms from Objectives 15 Through 19	65
9—Terms from Objectives 20 Through 24	67
10—Terms from Objectives 25 and 26	69
Answers to Crossword Puzzles	71
Module Review	75
Answers to Module Review	103

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module is the third in a series of four dealing with the circulatory system, including lymphatics. Because these modules are so interrelated, you may want to review the objectives in the other modules in this series and decide the sequence of presentation without regard to modules.

- Use crossword puzzles 1 through 10 to help reinforce the terms in the associated objectives.
- Objective 1 through Objective 4 define the term *vascular system*, list the major structures of the vascular system, define the term *systemic circulation system*, and state the sequence of blood circulation through the systemic circulation system. Use these objectives as an overall introduction to the module and the structures of the vascular system that students will study in the objectives that follow.
- Use the following strategies to supplement your discussion of the major arteries in the systemic arterial circulation system presented in Objective 5 through Objective 10.
  - — Using illustrations, models, and actual arteries, discuss the parts of an artery. Help the students remember the order of the layers by relating the positions to Latin stem words with which they are familiar. For example, *ad* in Latin means "out" or "to" and *adventitia* means "coming from outside." Words such as *adventure* and *advent* derive from the same root. The term *adduction* means "movement toward the midline," implying moving from outside to inside. Thus, the adventitia is the outside covering. *Media* means "middle" as in "medium" or "medial." *Intima* means "innermost" as one's intimate friends.
  - — Have the students dissect animal arteries and examine them under a microscope. Ensure that all the students are able to recognize the three layers and their composition. Discuss reasons for the multi-layer structure and the role of each type of tissue, emphasizing strength, elasticity, and flexibility. You may want to provide the class with a cross-section of a radial tire to show them a similar construction and biasing.
  - — Using illustrations and models, discuss the aorta. Have students trace the upper and lower portions of the aorta and identify its branches.
  - — Expand your discussion of the aorta to discuss all of the major arteries. The chart in Figure 3 lists many of the major arteries, while the illustration in Figure 4 provides labeling only for the major arteries. Decide whether you want to test additional arteries beyond those in the information sheet and, if so, provide the students with information about the additional arteries and modify other components, including the test, to include the additional arteries. Help the students to relate names and locations based on body parts.

- Using illustrations and models, discuss the major arteries and the body areas that they serve. Reinforce the material by quizzing the students with different illustrations and by switching between whether you ask for the body part served or the arterial structure that serves a given body area.

- To supplement Objective 11, discuss the structure and functioning of capillaries. Help the students to understand the overall concept of circulation based on their knowledge of arteries, veins, and capillaries. Demonstrate osmosis. One method is to use colored water and show how it travels into a sponge or celery stick. Discuss the low-pressure levels involved in cell osmosis, and ask the students to explain why low pressures are required.

- Use the following strategies to supplement your discussion of the major veins in the systemic circulation system presented in Objective 12 through Objective 16.

  - Using illustrations, models, and actual veins, discuss the parts of a vein. Compare and contrast the structure of the vein with that of an artery.

  - Discuss the flow of blood through the body from the heart to return to the heart. Have students trace this flow through various branches of the body by naming and indicating specific arteries and veins on drawings of the circulatory system.

- Use illustrations and models to discuss portal circulation as presented in Objective 17 and Objective 18. Discuss the importance of portal circulation in terms of providing nutrients and in detoxifying the blood. Review heart-back-to-heart circulation and have students describe how portal circulation fits in.

- Objective 19 through Objective 21 discuss the pulse points. Demonstrate taking pulses at various points. Allow the students to practice taking pulses. Demonstrate the differences between resting pulse and pulse after exercise. Discuss reasons for checking the pulse and abnormalities. Discuss reasons for choosing one pulse point over another.

- Objective 22 and Objective 23 discuss blood pressure and how it is measured. Demonstrate and allow students to practice the use of various blood-pressure monitors. Discuss factors that affect blood pressure and the accuracy of blood-pressure readings. Discuss the normal fluctuations in blood pressure during the day. Discuss the "white coat factor" in which a person's blood pressure may go up just because of being examined. Discuss ways of addressing hypertension.

- To supplement Objective 25, which concerns the fetal circulation system, use illustrations and models of fetal circulation. Demonstrate the use of a fetal heart monitor and describe its role in the labor process. Invite an obstetrician to speak to the class about fetal circulation, fetal development, and delivery. Observe ultrasounds of fetuses or view sonograms.

- To supplement Objective 26, discuss each of the disorders and abnormalities of the vascular system and related circulatory issues presented in the Information Sheet. Discuss medical and surgical procedures associated with each condition. View a video and display equipment used in circulatory procedures, including balloon angioplasty.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.

- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.

- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified*, 2nd ed. Philadelphia: F.A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy*, 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology*. Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology*, 3rd ed. Philadelphia: F.A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills*. Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology*, 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites deal primarily with the vascular system though other elements of the circulatory system are addressed. Resources provided in other modules may also be applicable to this module.

- http://www.ctru.auckland.ac.nz/atlas/intro/cardiac.htm

  This site offers an atlas that provides nearly 100 cross-sectional views of the cardiac anatomy created with an MRI scanner. The views are labeled and taken along different axes.

- http://www.heartsite.com/index.html

  Although designed for patients with heart-related complaints, this site contains a great deal of information about the heart and its disorders.

- http://sln.fi.edu/biosci/biosci.html

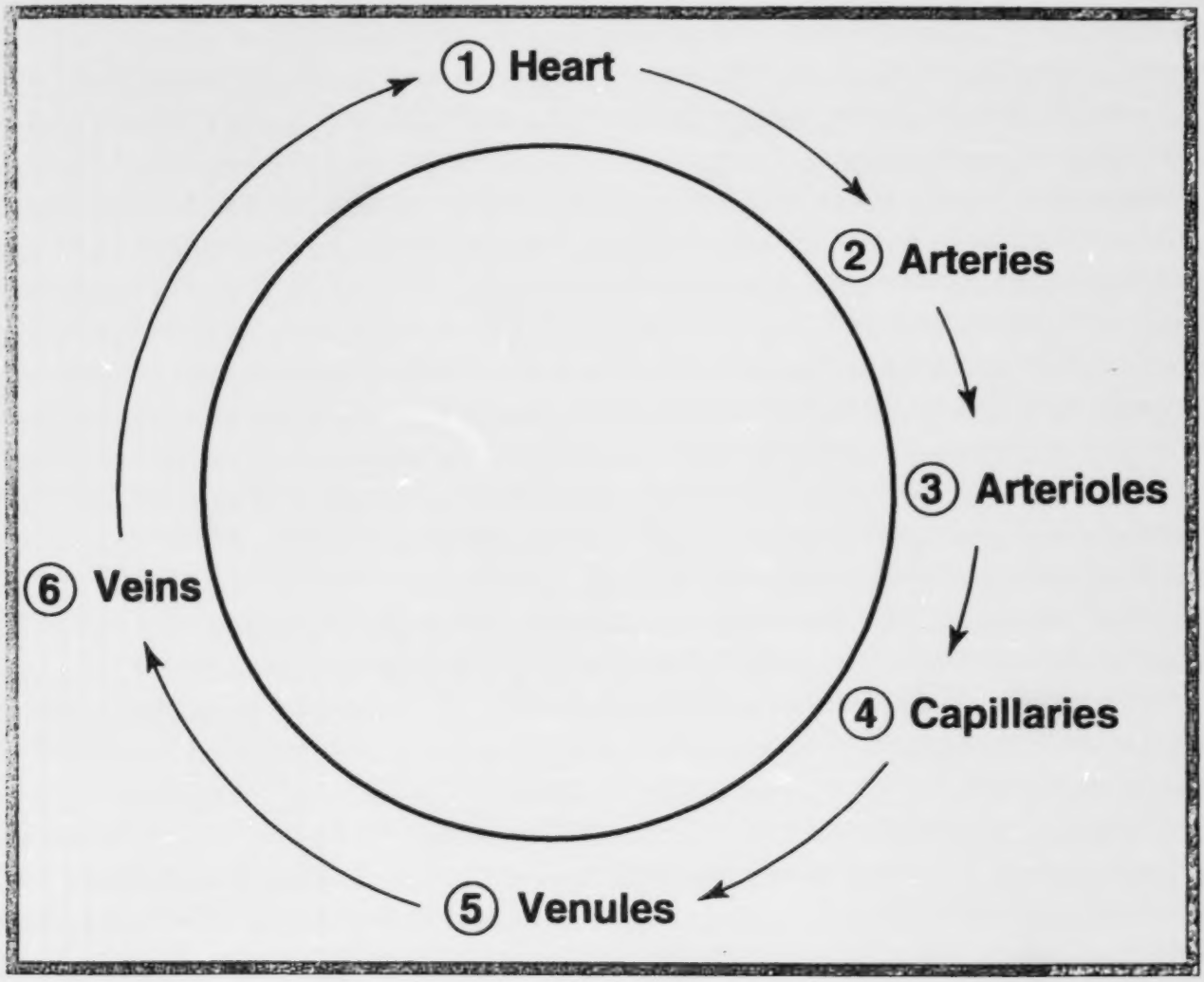
  This site allows students to explore the heart, its structure and development, the flow of blood, and its relationship to other body systems. Also presents information about heart health and the history of heart science.

- http://www.heartcenteronline.com

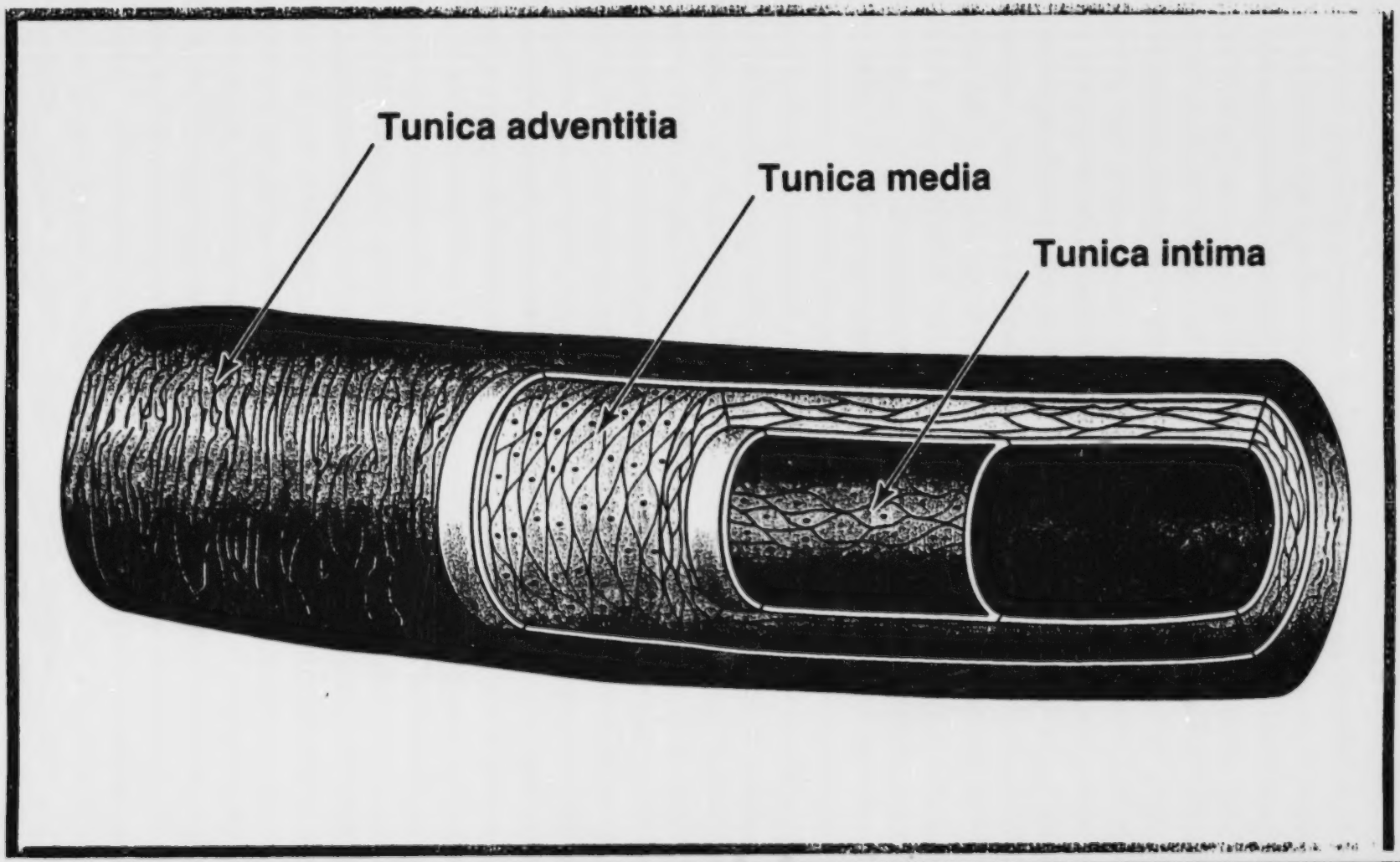
  Designed as an informational site for heart patients and cardiologists, the site also contains an illustration and animation library.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

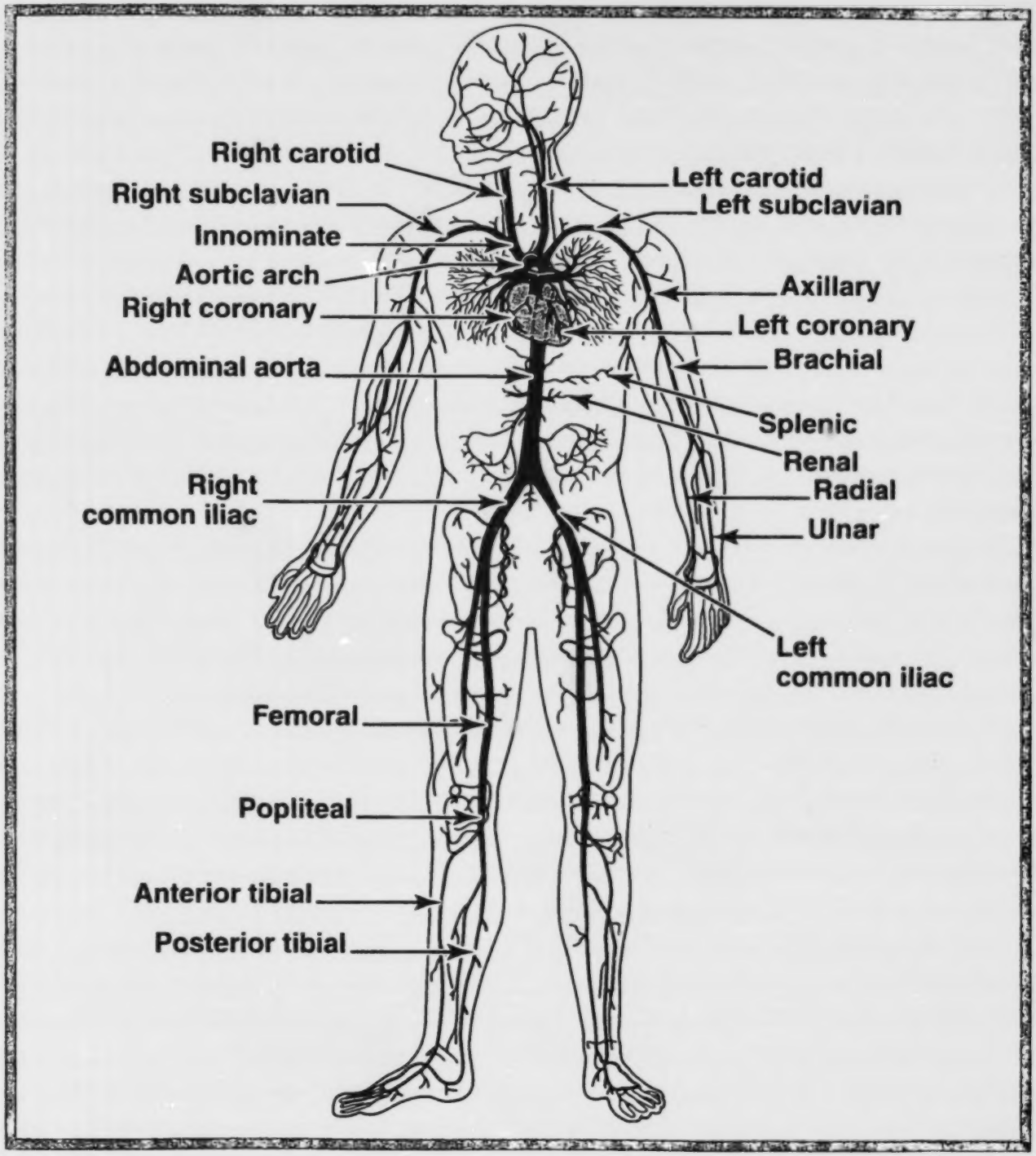
Sequence of Blood Circulation Through the Systemic Circulation System



The Tissue Layers of an Artery



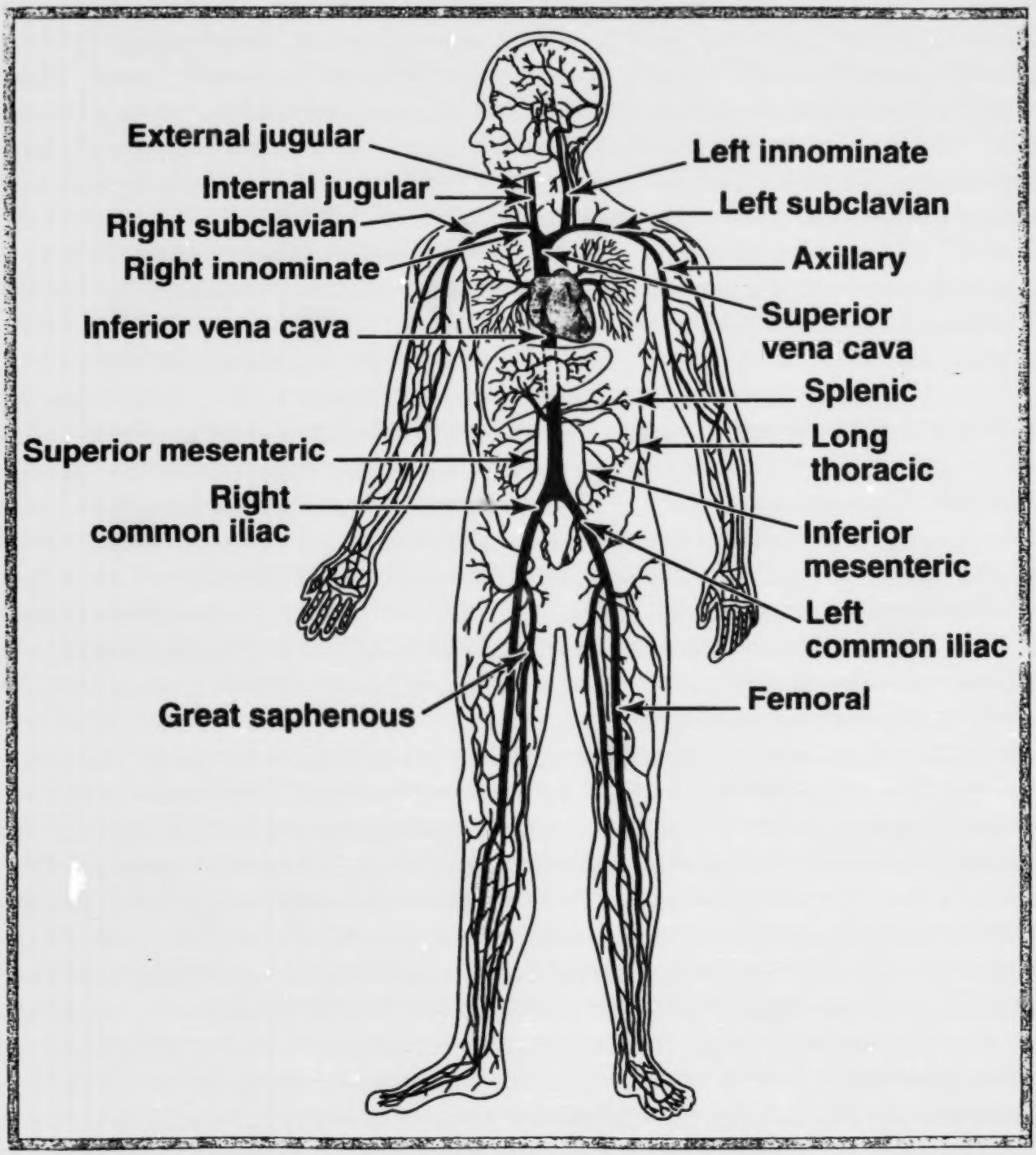
Major Arteries of the Systemic Circulation System



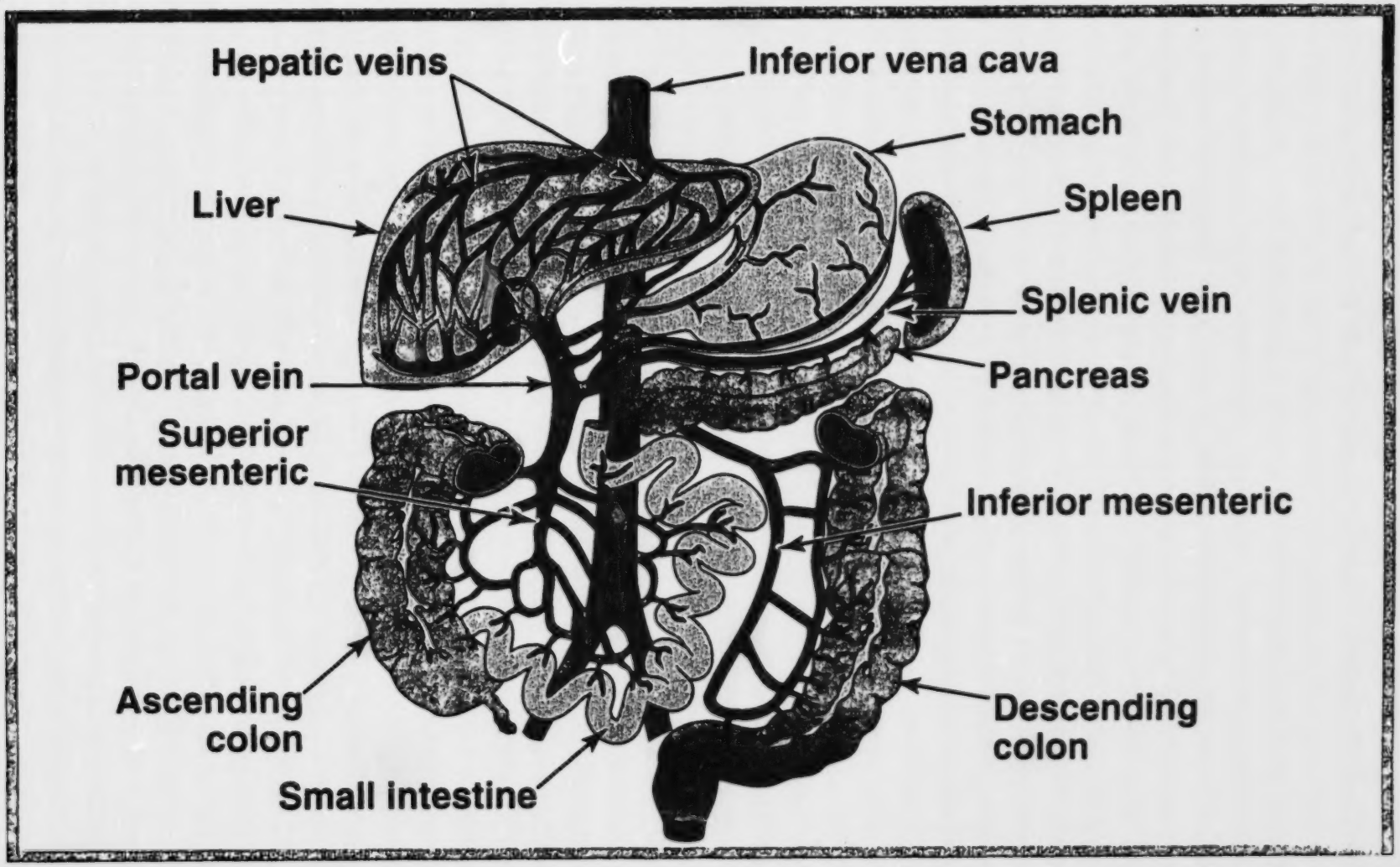
Module Set II: Major Body Systems
Module 9: Circulatory System—Vascular

The Tissue Layers of a Vein

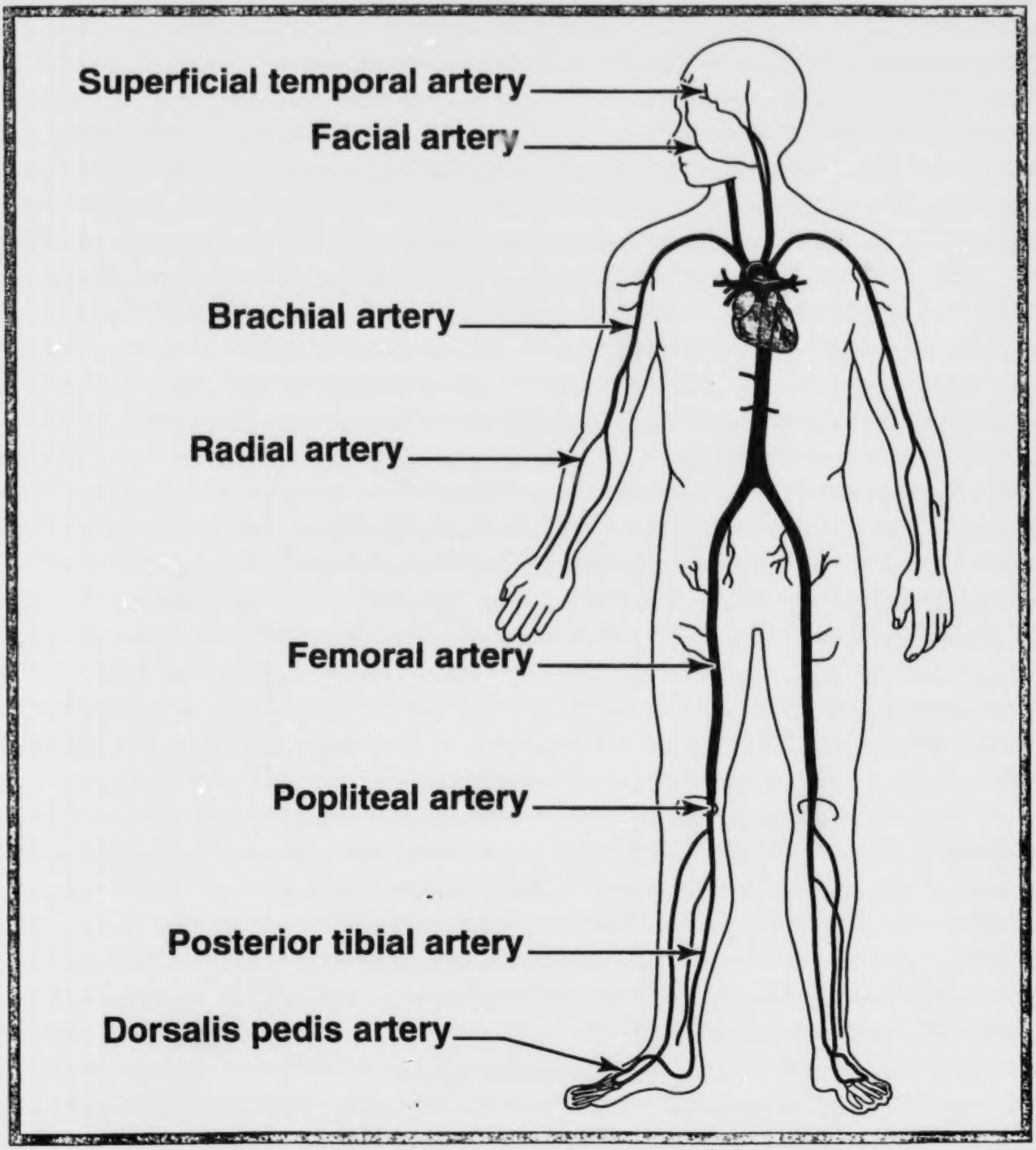
Major Veins of the Systemic Circulation System



Major Structures of the Portal Circulation System



Common Pulse Points



Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *vascular system*. Write your answer on the blank lines provided beside the term below.

Vascular system _____

_____

Objective 2 List the major structures of the vascular system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

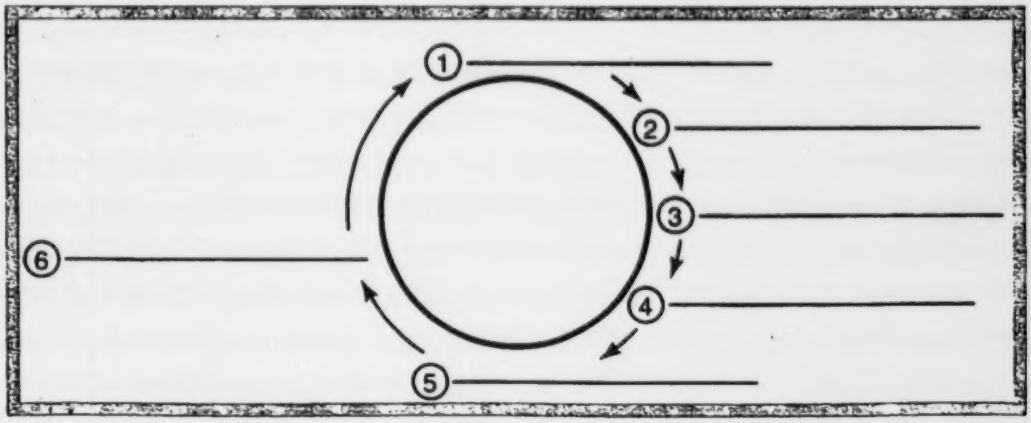
e. _____

Objective 3 Define the term *systemic circulation system*. Write your answer on the blank lines provided beside the term below.

Systemic circulation system _____

_____

Objective 4 State the sequence of blood circulation through the major structures of the systemic circulation system. Write your answers on the blank lines provided in the illustration below.



Objective 5 Define the tissue layers of an artery. Write your answers on the blank lines provided beside each of the terms below.

a. Tunica intima _____

_____

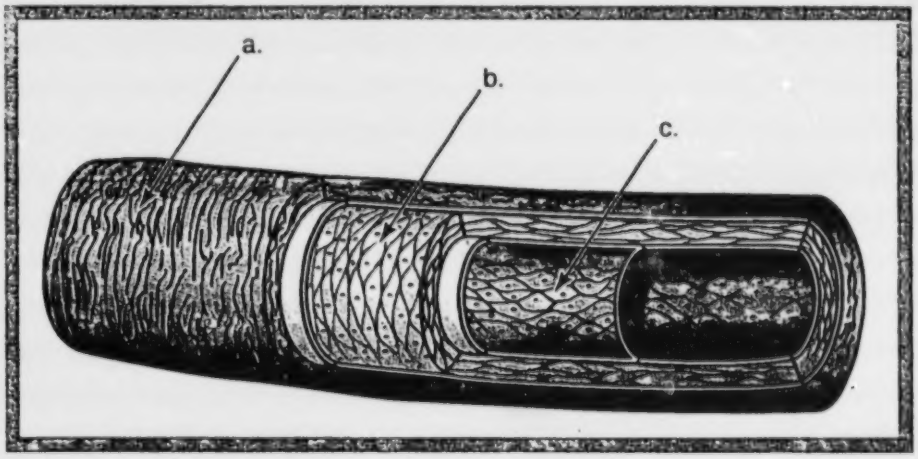
b. Tunica media _____

_____

c. Tunica adventitia _____

_____

Objective 6 Label the tissue layers of an artery. Write your answers on the blank lines provided below the following illustration.



a. _____ c. _____

b. _____

Objective 7 Complete statements that describe the characteristics of arteries. Write your answers on the blank lines provided in the statements below and on the next page.

a. Beginning with the aorta, most arteries carry _____ blood away from the heart; the pulmonary artery is an exception, as it carries _____ blood from the heart to the lungs.

b. Arteries branch into arterioles and arterioles branch into _____.

c. The walls of arteries are supplied with oxygen and nutrients by a network of small blood vessels called the _____.

d. The _____ causes an artery to stand open when cut.

e. Many arteries are referred to by different names as they pass through different areas of the _____.

OBJECTIVE 8

Complete statements that describe the characteristics of the aorta in the systemic arterial circulation system. Write your answers on the blank lines provided in the statements below.

a. The aorta is the _____ of the systemic arterial circulation system.

b. The aorta consists of three major branches: (1) the _____, (2) the _____, and (3) the _____.

c. The _____ is the portion of the aorta that begins at the left ventricle and rises upward, branching into the left and right coronary arteries.

d. The _____ is the portion of the aorta that turns backward and to the left at the level of the fourth thoracic vertebra.

e. The main branches of the _____ are different on the right and left side of the body.

f. On the right side, the _____ branches into a short artery called the *innominate artery*, which then branches into the _____ artery and the _____ artery.

g. On the left side, the _____ branches directly into the left carotid artery and the left subclavian artery.

h. The descending aorta forms two branches as it passes through the body: (1) the _____ aorta as it passes through the thoracic cavity and (2) the _____ aorta as it passes through the abdominal cavity.

i. The _____ aorta and the _____ aorta each branch into many branches.

j. The descending aorta ends near the fourth lumbar vertebra at the _____, forming the right common _____ artery and the left common _____ artery.

OBJECTIVE 9

Define the major arteries that extend from the aorta. Write your answers on the blank lines provided beside each of the terms below and on the following pages.

Arteries from the aortic arch

a. Right subclavian artery _____

b. Left subclavian artery _____

c. Right carotid artery _____

d. Left carotid artery _____

e. Axillary artery _____

f. Brachial artery _____

g. Radial artery _____

h. Ulnar artery _____

Arteries from the thoracic aorta

i. Bronchial arteries _____

j. Esophageal arteries _____

k. Pericardial arteries _____

l. Intercostal arteries _____

m. Mediastinal branches _____

_____

n. Superior/phrenic arteries _____

_____

Arteries from the abdominal aorta

o. Celiac artery _____

_____

p. Hepatic artery _____

_____

q. Splenic artery _____

_____

r. Left gastric artery _____

_____

s. Superior mesenteric artery _____

_____

t. Inferior mesenteric artery _____

_____

u. Middle suprarenal branches _____

_____

v. Renal artery _____

_____

w. Testicular arteries _____

_____

x. Ovarian arteries _____

_____

y. Inferior phrenic arteries _____

_____

z. Lumbar arteries _____

_____

aa. Middle sacral artery _____

_____

Arteries from the descending aorta

bb. Right and left common iliac arteries _____

_____

cc. Internal iliac arteries _____

_____

dd. External iliac arteries _____

_____

ee. Femoral artery _____

_____

ff. Popliteal artery _____

_____

gg. Tibial arteries _____

_____

OBJECTIVE 10 Label the major arteries of the systemic circulation system. Write your answers on the blank lines provided below, using the illustration on the next page.

a. _____ l. _____

b. _____ m. _____

c. _____ n. _____

d. _____ o. _____

e. _____ p. _____

f. _____ q. _____

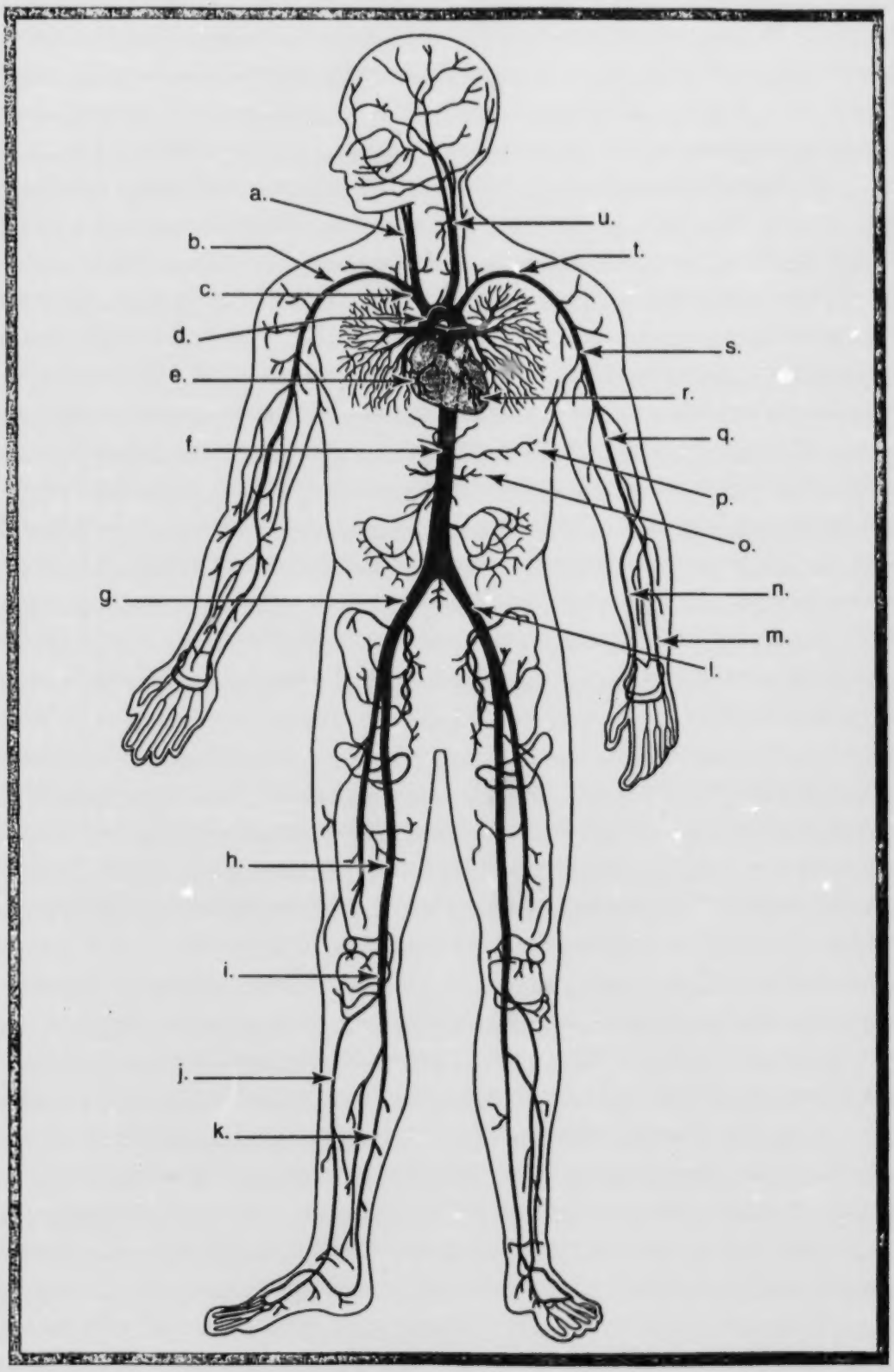
g. _____ r. _____

h. _____ s. _____

i. _____ t. _____

j. _____ u. _____

k. _____


a.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.
u.
t.
s.
r.
q.
p.
o.
n.
m.
l.

Objective 11 Complete statements that describe the characteristics of capillaries. Write your answers on the blank lines provided in the statements below.

a. Capillaries connect _____ and _____.

b. Capillaries are minute vessels with walls that are only _____ thick.

c. Nutrients and oxygen move from the capillaries through the capillary walls and into the cells of the body by _____.

d. Wastes move from the cells of the body through the capillary walls and into the capillaries by _____.

Objective 12 Define the tissue layers of a vein. Write your answers on the blank lines provided beside each of the terms below.

a. Tunica intima _____

_____

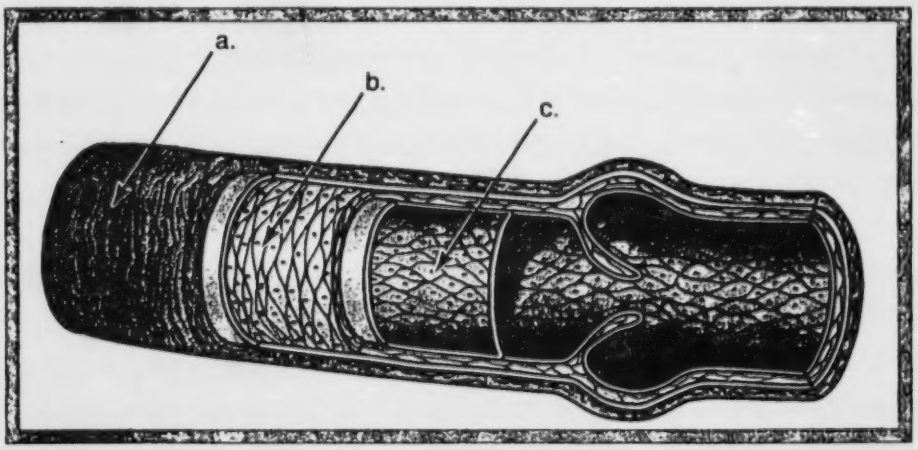
b. Tunica media _____

_____

c. Tunica adventitia _____

_____

Objective 13 Label the tissue layers of a vein. Write your answers on the blank lines provided below the following illustration.



a. _____ c. _____

b. _____

Objective 14

Complete statements that describe the characteristics of veins. Write your answers on the blank lines provided in the statements below.

a. Most veins carry _____ blood to the vena cava of the heart; the pulmonary veins are an exception, as they carry _____ blood from the lungs to the heart.

b. Veins branch into venules and venules branch into _____.

c. The _____ layer of muscle tissue in a vein is not very well developed or very flexible.

d. The wall of a vein is relatively thin, causing a vein to _____ when cut.

e. Many veins contain _____ that prevent the backflow of blood.

f. Many veins share their names with the corresponding _____.

Objective 15

Define the major veins of the systemic circulation system. Write your answers on the blank lines provided beside each of the terms below and on the following pages.

a. Superior vena cava _____

b. Inferior vena cava _____

c. Innominate vein _____

d. Subclavian vein _____

e. Axillary vein _____

f. Internal jugular vein _____

g. External jugular vein _____

h. Long thoracic vein _____

i. Hepatic veins _____

j. Splenic vein _____

k. Portal vein _____

l. Superior mesenteric vein _____

_____

_____

_____

m. Inferior mesenteric vein _____

_____

_____

_____

n. Common iliac vein _____

_____

_____

_____

o. Femoral vein _____

_____

_____

_____

p. Great saphenous vein _____

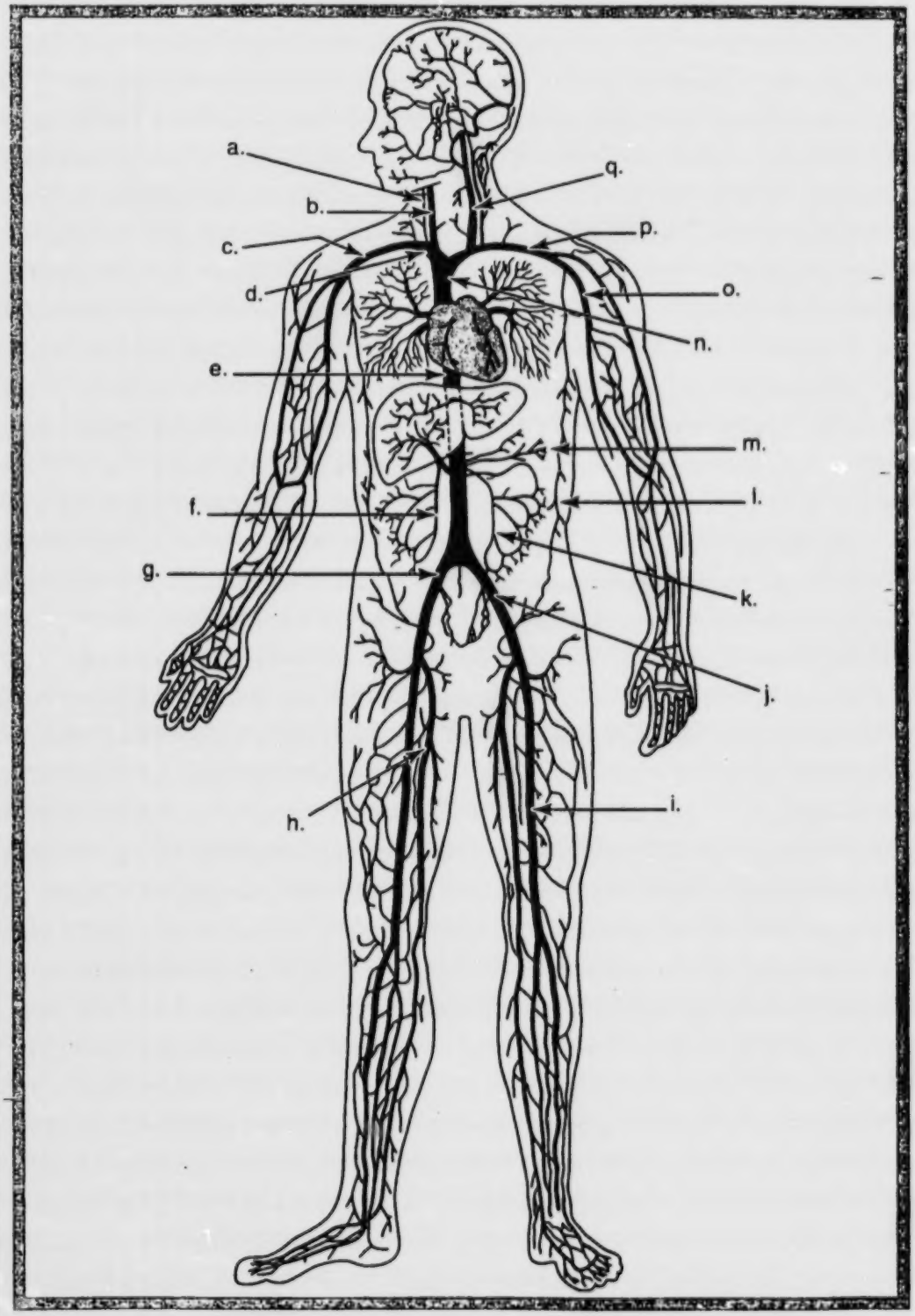
_____

_____

_____

OBJECTIVE 16

Label the major veins of the systemic circulation system. Write your answers on the blank lines provided on the next page.



a. _____ j. _____

b. _____ k. _____

c. _____ l. _____

d. _____ m. _____

e. _____ n. _____

f. _____ o. _____

g. _____ p. _____

h. _____ q. _____

i. _____

Objective 17 Define the term *portal circulation system*. Write your answer on the blank lines provided beside the term below.

Portal circulation system _____

_____

Objective 18 Complete statements that describe the characteristics of the portal circulation system. Write your answers on the blank lines provided in the statements below.

a. Veins from the _____, _____, _____, and _____ empty into the portal vein.

b. The portal vein then carries the blood loaded with digested food products to the _____, where the food is altered, stored, and released as needed.

c. The _____ removes toxins from the blood.

d. Blood leaves the _____ through the hepatic veins, which empty into the _____.

Objective 19 Define the term *pulse point*. Write your answer on the blank lines provided beside the term below.

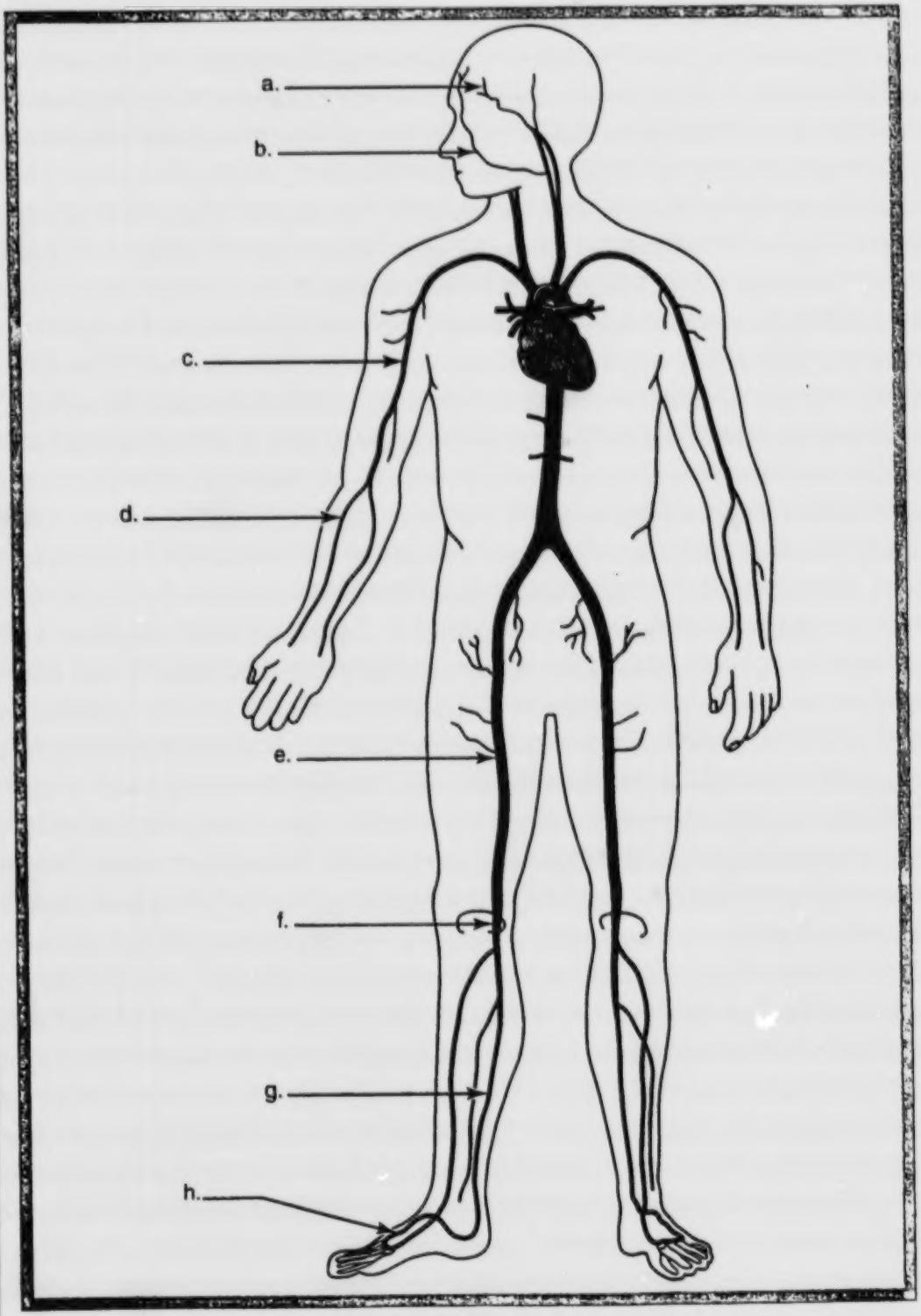
Pulse point _____

_____

Objective 20 State the normal pulse rate of a healthy adult at rest. Write your answer on the blank line provided below.

Normal pulse rate _____

OBJECTIVE 21 Label the common pulse points. Write your answers on the blank lines provided on the next page.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____ h. _____

Objective 22 Define the term *blood pressure*. Write your answer on the blank lines provided beside the term below.

Blood pressure _____

_____

_____

_____

Objective 23 Complete statements that describe how blood pressure is measured. Write your answers on the blank lines provided in the statements below.

a. Blood pressure is created by the contraction of the _____ in the heart.

b. The conventional measurement of blood pressure is in _____ of mercury, a measure of the force required to raise a column of liquid mercury in a tube.

c. Two points are taken in measuring blood pressure: the _____ and the _____.

d. The _____ is the contraction of the myocardium, which in ventricular contraction, causes blood to be pumped into the arteries.

e. The _____ is the dilation of the cavities of the heart during which they fill with blood.

f. The pressure in the aorta and the large arteries of a healthy young adult is approximately _____ and _____.

g. Blood-pressure measurements are always given stating the _____ first and the _____ second.

OBJECTIVE 24

Describe the factors that affect blood pressure. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Heart force _____

b. Heart rate _____

c. Peripheral vascular resistance _____

d. Elasticity of arteries _____

e. Blood volume _____

f. Blood viscosity _____

_____

_____

_____

_____

g. Hormones _____

_____

_____

_____

_____

h. Chemicals _____

_____

_____

_____

_____

OBJECTIVE 25

Complete statements that describe the characteristics of the fetal circulation system. Write your answers on the blank lines provided in the statements below and on the next page.

a. The fetus depends on the mother for circulation of _____, the intake of _____ and _____, and the removal of _____ and _____.

b. In the placenta, the mother's blood vessels and those of the fetus come very close to each other; in this region, materials move between the two circulatory systems by _____ through the walls of the blood vessels and by _____ mechanisms.

c. The placenta is joined to the fetus by the _____, a sheath that covers the umbilical blood vessels; the umbilical blood vessels consist of _____ vein and _____ arteries.

d. The umbilical arteries are branches of the fetus' _____ arteries and allow deoxygenated fetal blood to flow to the placenta, where it becomes enriched with oxygen and nutrients.

e. The enriched blood flows from the placenta to the fetus in the _____ vein.

f. Some of the venous blood flows to the fetal liver, but most flows to the heart through the _____ and into the inferior vena cava.

g. Blood enters the _____ atrium of the fetal heart.

h. The fetal heart contains an opening between the right and left atria called the _____, allowing some blood to flow to the left atrium.

i. The pumping of the right ventricle pushes blood into the pulmonary artery; however, a special fetal blood vessel called the _____ diverts blood to the body and away from the fetal lungs, which are collapsed during gestation.

j. When the baby begins breathing after delivery, the expansion of the _____ pulls blood into the pulmonary artery and to the lungs.

k. Blood returning from the lungs to the left atrium causes a flap to close over the _____, which seals within a few days.

l. The _____ constricts as pulmonary flow increases.

m. The umbilical veins and arteries _____ once blood stops flowing through them.

Objective 26

Define common disorders and abnormalities of the vascular system. Write your answers on the blank lines provided beside each of the terms below and on the following pages.

a. Arteriosclerosis _____

_____

_____

_____

_____

b. Atherosclerosis _____

c. Aneurysm _____

d. Phlebitis _____

e. Varicose veins _____

f. Hemorrhoids _____

g. Hypertension _____

h. Circulatory shock _____

i. Septic shock _____

Answers to Written Test

OBJECTIVE 1

The portion of the cardiovascular system that deals with the blood vessels that allow for the circulation of blood throughout the body

OBJECTIVE 2

Answers may appear in any order.

a. Arteries
b. Arterioles
c. Capillaries
d. Venules
e. Veins

OBJECTIVE 3

The circulation system that supplies those parts of the body that receive blood through the aorta rather than through the pulmonary artery

OBJECTIVE 4

Answers **must** appear in this order.

a. Heart
b. Arteries
c. Arterioles
d. Capillaries
e. Venules
f. Veins

OBJECTIVE 5

a. The innermost tissue layer of an artery that is composed of endothelium

b. The middle tissue layer of an artery that is composed of involuntary muscle tissue and elastic connective tissue that permits constriction and dilation of the artery

c. The outermost tissue layer of an artery that is composed of fibrous connective tissue

OBJECTIVE 6

a. Tunica adventitia
b. Tunica media
c. Tunica intima

OBJECTIVE 7

a. oxygenated; deoxygenated
b. capillaries
c. vasa vasorum
d. tunica intima
e. body

Objective 8

a. main trunk
b. ascending aorta; aortic arch; descending aorta
c. ascending aorta
d. aortic arch
e. aortic arch
f. aortic arch; right carotid; right subclavian
g. aortic arch
h. thoracic; abdominal
i. thoracic; abdominal
j. aortic bifurcation; iliac; iliac

Objective 9

a. The main artery from the aortic arch that supplies the right arm and the surrounding area

b. The main artery from the aortic arch that supplies the left arm and the surrounding area

c. The main artery from the aortic arch that supplies the right side of the head, neck, and brain

d. The main artery from the aortic arch that supplies the left side of the head, neck, and brain

e. One of a pair of the continuations of the subclavian arteries that supplies various chest muscles and arm muscles

f. The principal artery of the upperarm that is the continuation of the axillary artery

g. An artery of the forearm starting at the bifurcation of the brachial artery and passing in 12 branches supplying the forearm, wrist, and hand

h. A large artery branching from the brachial artery and supplying muscles in the forearm, wrist, and hand; it has nine branches: four in the forearm, two in the wrist, and three in the hand

i. The arteries from the thoracic aorta that supply the bronchi of the lungs

j. The arteries from the thoracic aorta that supply the esophagus

k. The arteries from the thoracic aorta that supply the pericardium

l. The nine or ten pairs of arteries from the thoracic aorta that supply the intercostal areas

m. The artery branches that supply the lymph glands and the posterior mediastinum

n. The arteries from the thoracic aorta that supply the diaphragm

o. The artery from the abdominal aorta that supplies the stomach, liver, and spleen

p. The branch of the celiac artery that supplies the liver

q. The branch of the celiac artery that supplies the spleen

OBJECTIVE 9 (CONTINUED)

r. The branch of the celiac artery that supplies the stomach

s. The artery from the abdominal artery that supplies all of the small intestine except the superior portion of the duodenum

t. The artery from the abdominal artery that supplies all of the colon and rectum except the right half of the transverse colon

u. The branches of the abdominal artery that supply the adrenal (suprarenal) glands

v. One of a pair of large branches of the abdominal aorta that supplies the kidneys, suprarenal glands, and the ureter

w. The pair of long, slender branches of the abdominal aorta that supplies the testes and ureter in a male

x. The pair of slender branches of the abdominal aorta that supplies the ovaries, part of the ureters, and uterine tubes in a female

y. The arteries from the abdominal aorta that supply the diaphragm and esophagus

z. The arteries from the abdominal aorta that supply the psoas muscles and part of the muscles of the abdominal wall

aa. The artery from the abdominal aorta that supplies the sacrum and the coccyx

bb. The major arteries that branch from the bifurcation of the descending aorta and supply the areas of the body near the ilium

cc. The arteries that branch from the common iliac arteries to supply the pelvic organs

dd. The arteries that branch from the common iliac arteries to supply the lower extremities

ee. The extension of the external iliac artery into the lower limb that supplies various parts of the lower limb and trunk

ff. A continuation of the femoral artery that passes through the knee and divides into eight branches that supply various muscles of the thigh, leg, and foot

gg. The anterior and posterior arteries that branch below the popliteal artery and supply the muscles of the lower leg

Objective 10

a. Right carotid
b. Right subclavian
c. Innominate
d. Aortic arch
e. Right coronary
f. Abdominal aorta
g. Right common iliac
h. Femoral
i. Popliteal
j. Anterior tibial
k. Posterior tibial
l. Left common iliac
m. Ulnar
n. Radial
o. Renal
p. Splenic
q. Brachial
r. Left coronary
s. Axillary
t. Left subclavian
u. Left carotid

Objective 11

a. arterioles; venules
b. one cell layer
c. osmosis
d. osmosis

Objective 12

a. The innermost tissue layer of a vein that is composed of endothelium
b. The middle tissue layer of a vein that is composed of muscle tissue
c. The outermost tissue layer of a vein composed of connective tissue

Objective 13

a. Tunica adventitia
b. Tunica media
c. Tunica intima

Objective 14

a. deoxygenated; oxygenated
b. capillaries
c. middle
d. collapse
e. valves
f. arteries

OBJECTIVE 15

a. The large vein of the body that returns deoxygenated blood from the upper half of the body to the right atrium

b. The large vein that returns deoxygenated blood to the heart from parts of the body below the diaphragm

c. One of a pair of large veins on either side of the neck that is formed by the union of the internal jugular and subclavian veins and drains blood from the head, neck, and upper extremities and unites to form the superior vena cava

d. One of a pair of veins on either side of the body that is a continuation of the axillary vein in the upper body, extending near the clavicle, where it joins the internal jugular vein to form the innominate vein; the subclavian veins drain the upper extremities

e. One of a pair of veins of the upper limb that is a continuation of the subclavian vein and drains deoxygenated blood from the area of the axilla

f. One of a pair of veins in the neck that collects blood from the brain, superficial parts of the face, and neck; both veins unite with the subclavian vein to form the innominate vein

g. One of a pair of large vessels in the neck that receives most of the blood from the exterior of the cranium and the deep tissues of the face

h. One of a pair of long veins on each side of the body that collects blood from the lateral thoracic wall

i. The three main veins—the right, middle, and left—that drain the blood of the liver into the inferior vena cava

j. A large vein of the lower body that returns blood from the spleen and part of the stomach

k. The vein that ramifies in the liver and ends in capillary-like structures that convey the blood to the inferior vena cava through the hepatic veins; the vein collects blood from the digestive tract

l. A tributary of the portal vein that drains blood from the small intestine, the cecum, and the ascending and the transverse colon

m. The vein in the lower body that returns blood from the rectum, the sigmoid, and descending parts of the colon

n. One of two veins on the left and right side of the body that are the sources of the inferior vena cava and drains blood from the pelvis and the legs

o. A large vein in the thigh that drains blood from the area of the thigh

p. One of a pair of the longest veins in the body that courses through the leg and thigh before ending in the femoral vein; the vein drains blood from the dorsum of the foot to the femoral vein just below the inguinal ligament

Objective 16

a. External jugular
b. Internal jugular
c. Right subclavian
d. Right innominate
e. Inferior vena cava
f. Superior mesenteric
g. Right common iliac
h. Great saphenous
i. Femoral
j. Left common iliac
k. Inferior mesenteric
l. Long thoracic
m. Splenic
n. Superior vena cava
o. Axillary
p. Left subclavian
q. Left innominate

Objective 17

The portion of the systemic circulation system that provides the pathway of blood flow from the gastrointestinal tract and spleen to the liver via the portal vein and its tributaries

Objective 18

a. stomach; intestines; spleen; pancreas
b. liver
c. liver
d. liver; inferior vena cava

Objective 19

Any one of the sites on the surface of the body where arterial pulsations can be easily felt

Objective 20

Between 60 to 80 beats per minute

Objective 21

a. Superficial temporal artery
b. Facial artery
c. Brachial artery
d. Radial artery
e. Femoral artery
f. Popliteal artery
g. Posterior tibial artery
h. Dorsalis pedis artery

Objective 22

The pressure exerted by the circulating volume of blood on the walls of the arteries, the veins, and the chambers of the heart

Objective 23

a. ventricles
b. millimeters (mm)
c. systole; diastole
d. systole
e. diastole
f. 120 mm Hg during systole; 70 mm Hg in diastole
g. systole; diastole

Objective 24

a. Heart force is one of the contributors of cardiac output, which includes both the amount of blood pumped and the force of the pumping action with each contraction. Abnormally hard contractions can lead to increased heart force and higher blood pressure; weak pumping in the heart will cause lowered blood pressure.

b. Increased heart rates result in lower blood pressure. As the heart beats faster, there is less time for the ventricles to fill with blood between contractions. Consequently, the blood-volume output of the heart is reduced and blood pressure goes down.

c. A greater amount of capillaries or other narrow vessels leads to an increase in blood pressure. The heart pumps blood through the blood vessels. However, because blood vessels grow ever narrower as the blood flows away from the heart, the vessels resist the flow of blood through them. This resistance is increased when the blood vessels become reduced in diameter. This may occur naturally with the constriction of blood vessels when the body is hot and as the arteries become peripheral capillaries or as a health factor as when fat builds up inside the blood vessels. Also, increased body mass along with the increase in capillary networks may lead to increased blood pressure.

d. A reduction in the elasticity of the arteries leads to increased blood pressure. The arteries are somewhat elastic and stretch as blood is forced through them. However, as a person ages or in certain disease conditions, some of this elasticity is lost. With reduced elasticity, blood pressure increases.

e. A loss in blood volume leads to lower blood pressure. If a person suffers a loss of blood or experiences internal bleeding, blood pressure will drop.

f. If the blood thickens, blood pressure will increase; if the blood grows thinner, blood pressure will decrease.The normal constituents of blood—red and white cells and plasma—produce a flowing liquid that can easily move through the circulatory system. However, environmental conditions or disease can cause an imbalance in blood components that results in blood being too thick or too thin. For example, smoking leads to an excess of red blood cells, which can cause high blood pressure. Some forms of anemia result in low red-blood-cell counts and low blood pressure.

g. Hormonal imbalances may lead to increases or decreases in blood pressure. While the mechanism behind blood-pressure regulation is not fully understood, the body uses hormones to help regulate blood pressure, often by constricting or relaxing the blood vessels. If these hormones become unbalanced because of stress or disease, abnormal blood pressure may persist.

h. Chemicals present in the blood may lead to increases or decreases in blood pressure. In the same way that hormones regulate blood pressure, chemicals entering the body may disrupt normal blood-pressure mechanisms. These may include drugs specifically intended to affect blood pressure or chemicals that do so as a by-product of other physiological effects.

Objective 25

a. blood; oxygen; nutrients; carbon dioxide; waste products
b. diffusion; active-transport
c. umbilical cord; one; two
d. internal iliac
e. umbilical
f. ductus venosus
g. right
h. foramen ovale
i. ductus arteriosus
j. lungs
k. foramen ovale
l. ductus arteriosus
m. constrict

Objective 26

a. A common arterial disorder characterized by thickening and loss of elasticity, resulting in a decreased blood supply, especially to the cerebrum and the lower extremities

b. A common arterial disorder characterized by yellowish plaque in the inner layers of the walls of large- and medium-sized arteries, causing the vessel walls to thicken and narrow, resulting in reduced blood flow to organs normally supplied by the artery

c. A localized sac or bubble that forms at a weak spot in the wall of a blood vessel

d. Inflammation of a vein that is often accompanied by the formation of a clot

e. Abnormally large, dilated veins that typically occur in the legs and are caused by congenitally defective valves, phlebitis, pregnancy, and obesity

f. A condition caused by abnormally dilated veins in the anal canal

g. A condition in which blood pressure is consistently higher than 140/90 mm Hg

h. The general term for any of the various conditions that result in decreased cardiac output and the deprivation of oxygen and nutrients to tissues

i. Circulatory shock that occurs as a result of a bacterial infection

Answers to Assignment Sheet

Assignment Sheet 1

Suggested answers

INVESTIGATION POINT 1

Carrying and delivering the baby can exert pressure on the anal canal, causing blood to pool. This pooling of blood can stretch the veins surrounding the anal canal.

INVESTIGATION POINT 2

In a person with high blood pressure, the heart must pump harder to overcome the high arterial pressure and move the blood through the system. This builds the heart muscle. However, the larger heart does not receive additional blood through the coronary capillaries. As a result, the heart is somewhat starved and suffocated. When the demand on the heart increases during stress or exercise, the inadequate oxygen supply may lead to angina and even myocardial infarction.

INVESTIGATION POINT 3

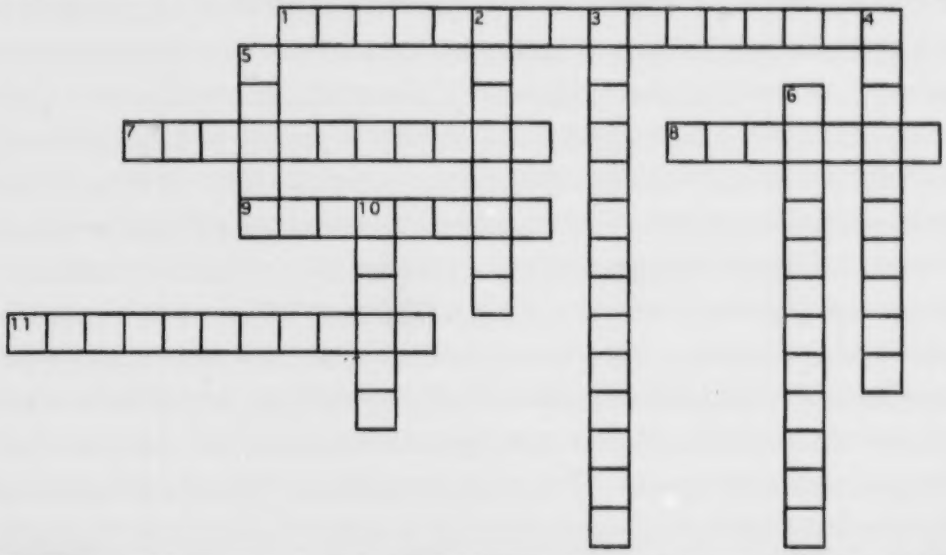
a. Norepinephrine increases the heart rate and the strength of contractions. If the receptors are blocked, norepinephrine cannot have this effect. Thus, administering blockers can reduce the strain on the heart and reduce a racing heart.

b. Ventricular contraction requires a flow of calcium to the sarcoplasm of the cardiac muscle. The calcium remains in the cardiac cell longer than in skeletal-muscle cells. Excess calcium flow or prolonged contraction of the muscle can produce excessively strong heartbeats or erratic heartbeats. The calcium blockers reduce the flow of calcium and, thus, the strength of cardiac contractions.

c. Myocardial infarction is caused by inadequate oxygen flow to the heart. By dilating the coronary arteries, more blood is able to flow to the myocardium, carrying with it more oxygen. The increased oxygen prevents necrosis of the myocardium.

Crossword Puzzle 1—Terms from Objectives 1 Through 5

Name _____ Date _____



ACROSS

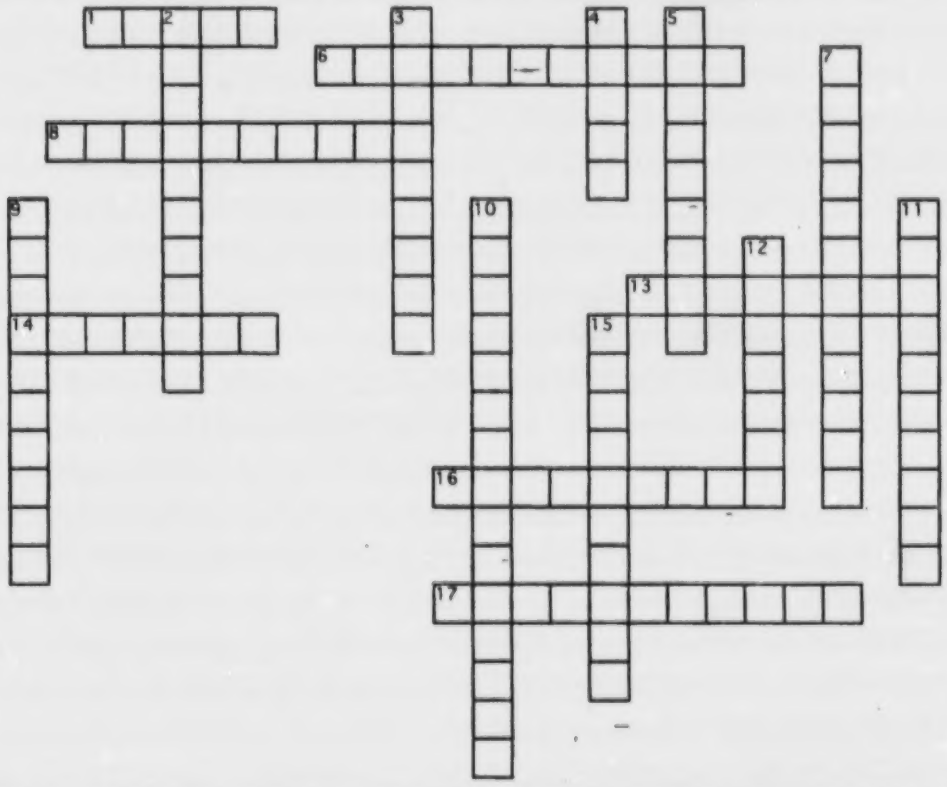
1. The outermost tissue layer of an artery that is composed of fibrous connective tissue (2 words)
7. The smallest blood vessels forming networks throughout the body
8. The minute veins connecting the capillaries with the larger veins
9. The _____ circulation system supplies those parts of the body that receive blood through the aorta rather than through the pulmonary artery
11. The middle tissue layer of an artery that is composed of involuntary muscle tissue and elastic connective tissue that permits constriction and dilation of the artery (2 words)

DOWN

2. The tubular, branching, muscular- and elastic-walled blood vessels that carry blood from the heart through the body
3. The portion of the cardiovascular system that deals with the blood vessels that allow for the circulation of blood throughout the body (2 words)
4. The small terminal twigs of an artery that end in capillaries
5. The many blood vessels that convey blood from the capillaries to the heart
6. The innermost tissue layer of an artery that is composed of endothelium (2 words)
10. An enveloping membrane or layer of body tissue

Crossword Puzzle 2—Terms from Objectives 7 and 8

Name _____ Date _____



ACROSS

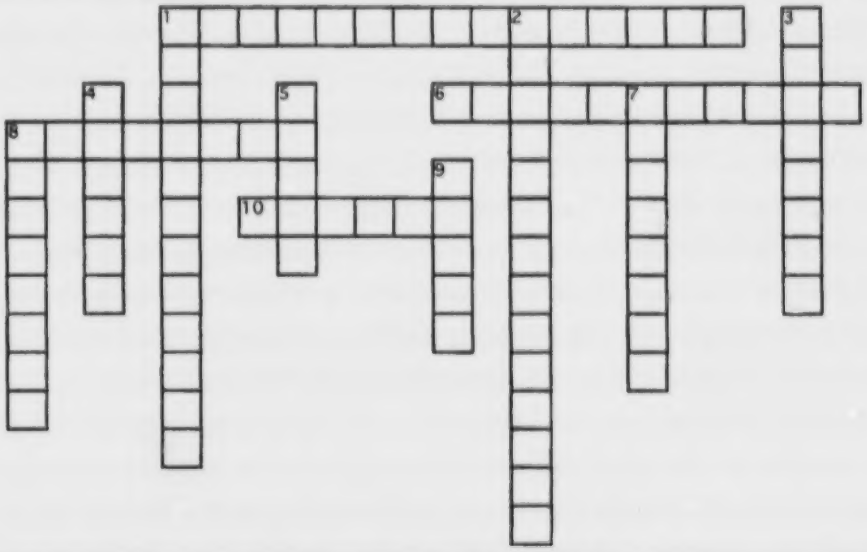
1. Of or relating to, or located near the ilium, the last division of the small intestine
6. A network of small blood vessels that supply the walls of arteries with oxygen and nutrients (2 words)
8. The _____ artery is the short artery that branches off the right side of the aortic arch; also called the *brachiocephalic artery*
13. They carry oxygenated blood away from the heart
14. Of or relating to or being the chief artery or pair of arteries that pass up the neck and supply the head
16. The _____ artery is the main artery of the leg as it passes through the knee
17. The point at which something divides into two branches or parts

DOWN

2. Having no name, unnamed
3. The portion of the aorta that begins at the left ventricle and rises upward, branching into the left and right coronary arteries is called the _____ *aorta*
4. The main trunk of the systemic arterial circulation system; consists of three major branches
5. The _____ artery carries deoxygenated blood from the heart to the lungs
7. The innermost tissue layer of an artery that causes an artery to stand open when cut (2 words)
9. Of or relating to or being a part (an artery, vein, or nerve) located under the clavicle
10. The _____ artery is the main artery of the leg as it passes through the lower leg (2 words)
11. The branch of the aorta that forms two branches as it passes through the body; ends near the fourth lumbar vertebra at the aortic bifurcation, forming the right common iliac artery and the left common iliac artery is called the _____ *aorta*
12. The _____ artery is the main artery of the leg as it passes through the thigh
15. The portion of the aorta that turns backward and to the left at the level of the fourth thoracic vertebra (2 words)

Crossword Puzzle 3—Terms from Objective 9

Name _____ Date _____



ACROSS

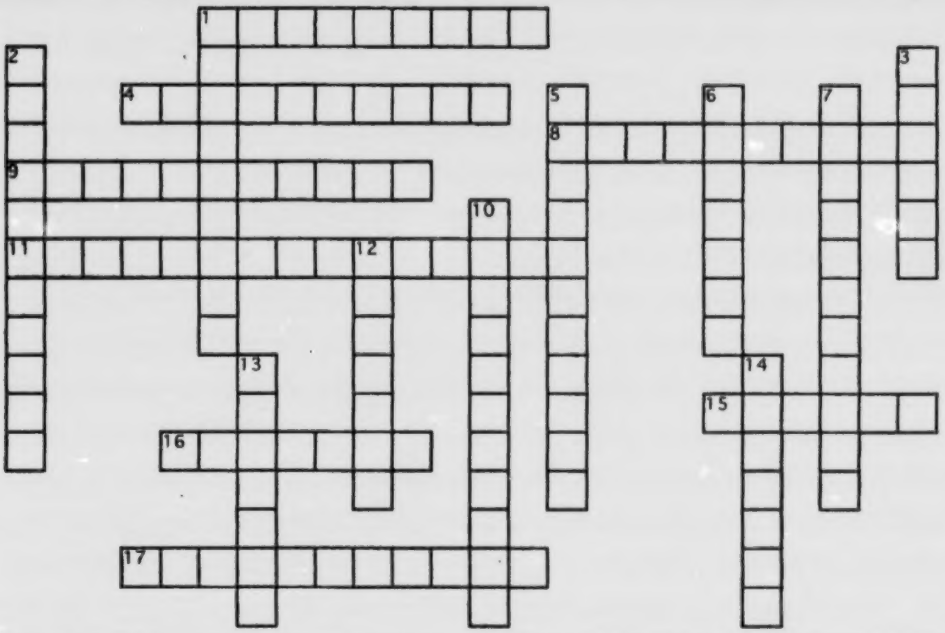
1. The _____ artery is the main artery from the aortic arch that supplies the right arm and the surrounding area (2 words)
6. The _____ artery is the main artery from the aortic arch that supplies the left side of the head, neck, and brain (2 words)
8. The _____ artery is the principal artery of the upperarm that is the continuation of the axillary artery
10. Pertaining to the radius, the bone of the forearm

DOWN

1. The _____ artery is the main artery from the aortic arch that supplies the right side of the head, neck, and brain (2 words)
2. The _____ artery is the main artery from the aortic arch that supplies the left arm and the surrounding area (2 words)
3. The _____ artery is one of a pair of the continuations of the subclavian arteries that supplies various chest muscles and arm muscles
4. The _____ artery is an artery of the forearm starting at the bifurcation of the brachial artery and passing in 12 branches supplying the forearm, wrist, and hand
5. The _____ artery is a large artery branching from the brachial artery and supplying muscles in the forearm, wrist, and hand; it has nine branches: four in the forearm, two in the wrist, and three in the hand
7. Pertaining to the armpit
8. Pertaining to the arm
9. Pertaining to the ulna, the bone on the little-finger side of the forearm

Crossword Puzzle 4—Terms from Objective 9 (cont.)

Name _____ Date _____



ACROSS

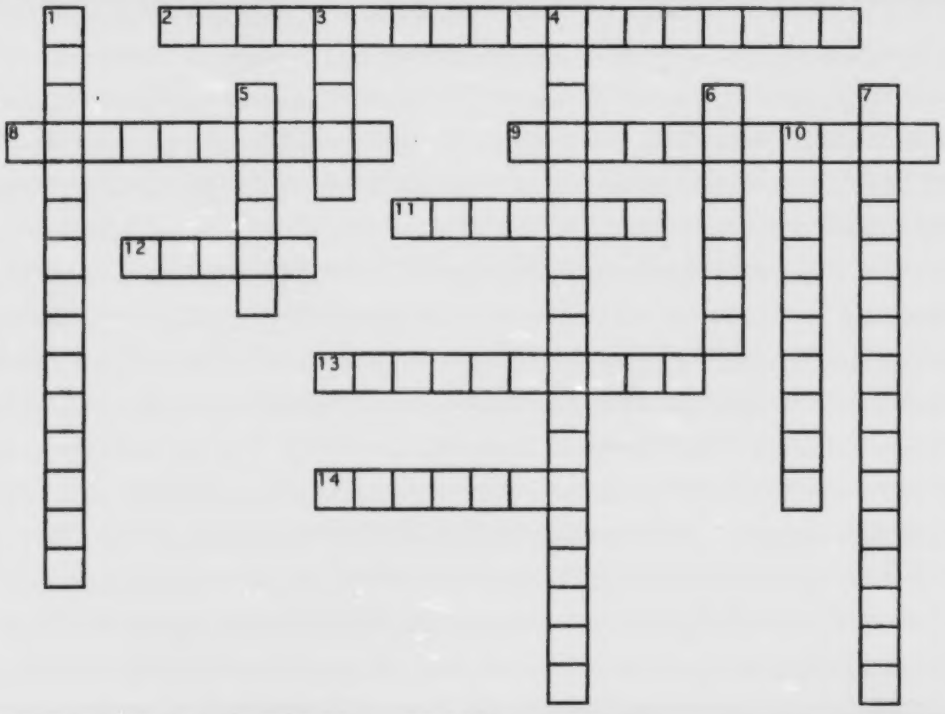
1. Of or relating to the bronchi of the lungs
4. The _____ arteries are from the thoracic aorta and supply the esophagus
8. Of or relating to the esophagus, the muscular tube that passes from the pharynx to the stomach
9. The nine or ten pairs of _____ arteries are from the thoracic aorta and supply the intercostal areas
11. The _____ arteries are from the thoracic aorta and supply the diaphragm (2 words)
15. Of or relating to the abdominal cavity
16. Relating to the spleen
17. Of or relating to the mediastinum, the space in the chest between the pleural sacs of the lungs that contains all of the viscera of the chest except the lungs

DOWN

1. The _____ arteries are from the thoracic aorta and supply the bronchi of the lungs
2. The artery branches that supply the lymph glands and the posterior mediastinum are called the _____ branches
3. The _____ artery is from the abdominal aorta and supplies the stomach, liver, and spleen
5. The _____ arteries are from the thoracic aorta and supply the pericardium
6. Of or relating to the diaphragm
7. Of or relating to the pericardium, the sac of serous membrane that encloses the heart
10. Situated or extending between the ribs
12. The _____ artery is the branch of the celiac artery that supplies the liver
13. The _____ artery is the branch of the celiac artery that supplies the spleen
14. Of or relating to the liver

Crossword Puzzle 5—Terms from Objective 9 (cont.)

Name _____ Date _____



ACROSS

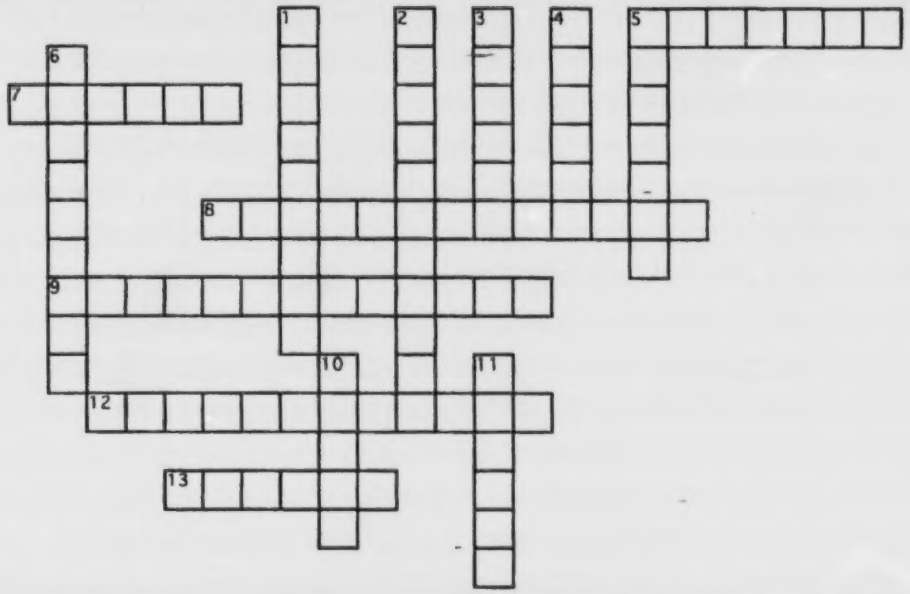
2. The _____ artery is from the abdominal artery and supplies all of the colon and rectum except the right half of the transverse colon (2 words)
8. The _____ arteries are a pair of long, slender branches of the abdominal aorta that supplies the testes and ureter in a male
9. The _____ artery is the branch of the celiac artery that supplies the stomach (2 words)
11. The _____ arteries are a pair of slender branches of the abdominal aorta that supplies the ovaries, part of the ureters, and uterine tubes in a female
12. Relating to the kidney
13. Pertaining to the mesentery, the double layer of peritoneum connecting the intestine to the abdominal wall
14. Of or relating to the ovaries, the female reproductive organs that produce eggs

DOWN

1. The _____ arteries are from the abdominal aorta and supply the diaphragm and esophagus (2 words)
3. The _____ artery is one of a pair of large branches of the abdominal aorta that supplies the kidneys, suprarenal glands, and the ureter
4. The _____ artery is from the abdominal artery and supplies all of the small intestine except the superior portion of the duodenum (2 words)
5. The _____ arteries are from the abdominal aorta and supply the psoas muscles and part of the muscles of the abdominal wall
6. Of or pertaining to the stomach
7. The _____ branches of the abdominal artery supply the adrenal (suprarenal) glands (2 words)
10. Pertaining to the testes, the male gonads

Crossword Puzzle 6—Terms from Objective 9 (cont.)

Name _____ Date _____



ACROSS

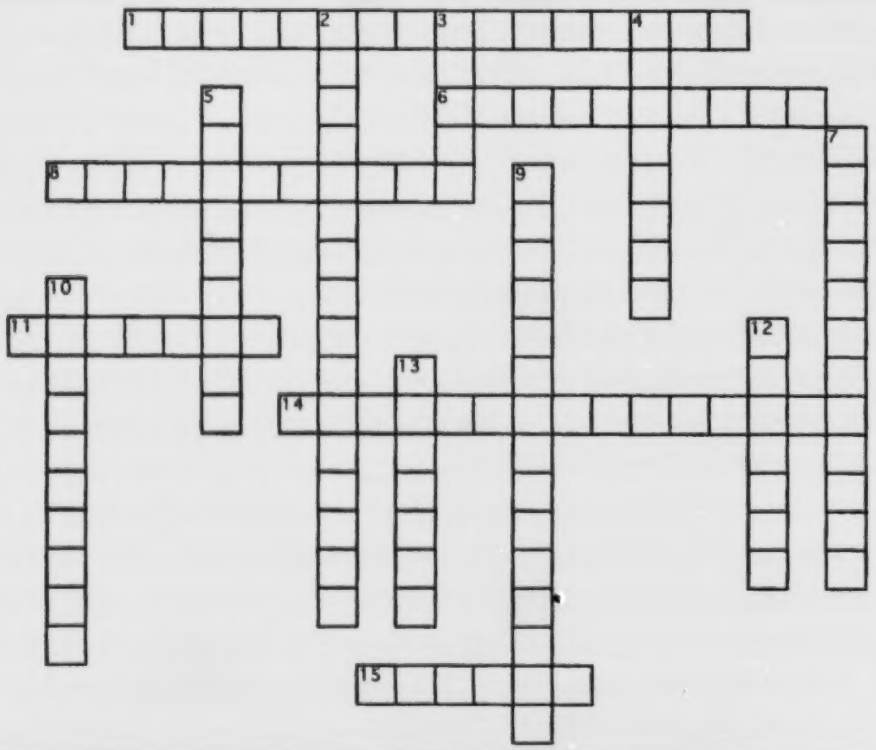
5. Of or pertaining to the femur or the thigh
7. The beaklike bone joined to the sacrum
8. The _____ arteries branch from the common iliac arteries to supply the pelvic organs (2 words)
9. The _____ arteries branch from the common iliac arteries to supply the lower extremities (2 words)
12. The _____ artery is from the abdominal aorta and supplies the sacrum and the coccyx (2 words)
13. Of or pertaining to the part of the body between the thorax and the pelvis

DOWN

1. The _____ artery is a continuation of the femoral artery that passes through the knee and divides into eight branches that supply various muscles of the thigh, leg, and foot
2. The major arteries that branch from the bifurcation of the descending aorta and supply the areas of the body near the ilium are called the *right* and *left* _____ *arteries* (2 words)
3. The anterior and posterior arteries that branch below the popliteal artery and supply the muscles of the lower leg are called the _____ *arteries*
4. Pertaining to the largest long bone of the lower leg, the tibia
5. The _____ artery is the extension of the external iliac artery into the lower limb that supplies various parts of the lower limb and trunk
6. Of or relating to the back part of the leg behind the knee joint
10. These muscles are in the area of the lumbar vertebrae and pelvis
11. Of or pertaining to the sacrum, the large triangular bone at the dorsal part of the pelvis

Crossword Puzzle 7—Terms from Objectives 11 Through 15

Name _____ Date _____



ACROSS

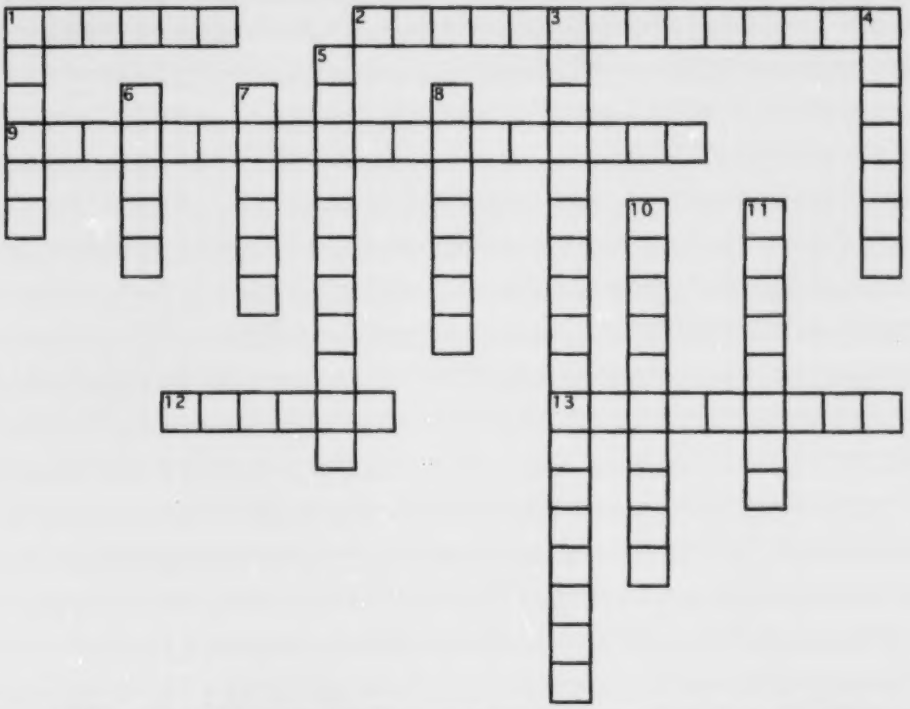
1. The large vein of the body that returns deoxygenated blood from the upper half of the body to the right atrium (3 words)
6. The _____ vein is one of a pair of large veins on either side of the neck that is formed by the union of the internal jugular and subclavian veins and drains blood from the head, neck, and upper extremities and unites to form the superior vena cava; also called the *brachiocephalic vein*
8. Minute vessels with walls that are only one cell layer thick; connect arterioles and venules
11. Of or relating to the throat or neck
14. The _____ vein is one of a pair of veins in the neck that collects blood from the brain, superficial parts of the face, and neck; both veins unite with the subclavian vein to form the innominate vein (2 words)
15. The _____ vein ramifies in the liver and ends in capillary-like structures that convey the blood to the inferior vena cava through the hepatic veins; the vein collects blood from the digestive tract

DOWN

2. The large vein that returns deoxygenated blood to the heart from parts of the body below the diaphragm (3 words)
3. Blood vessels that carry deoxygenated blood to the vena cava of the heart; many contain valves that prevent the backflow of blood; collapse when cut
4. The _____ vein is one of a pair of veins of the upper limb that is a continuation of the subclavian vein and drains deoxygenated blood from the area of the axilla
5. _____ veins carry oxygenated blood from the lungs to the heart
7. The _____ vein is one of a pair of long veins on each side of the body that collects blood from the lateral thoracic wall (2 words)
9. The _____ vein is one of a pair of large vessels in the neck that receives most of the blood from the exterior of the cranium and the deep tissues of the face (2 words)
10. The _____ vein is one of a pair of veins on either side of the body that is a continuation of the axillary vein in the upper body, extending near the clavicle, where it joins the internal jugular vein to form the innominate vein; the subclavian veins drain the upper extremities
12. The _____ vein is a large vein of the lower body that returns blood from the spleen and part of the stomach; also called the *lienal vein*
13. The _____ veins are the three main veins that drain the blood of the liver into the inferior vena cava

Crossword Puzzle 8—Terms from Objectives 15 Through 19

Name _____ Date _____



ACROSS

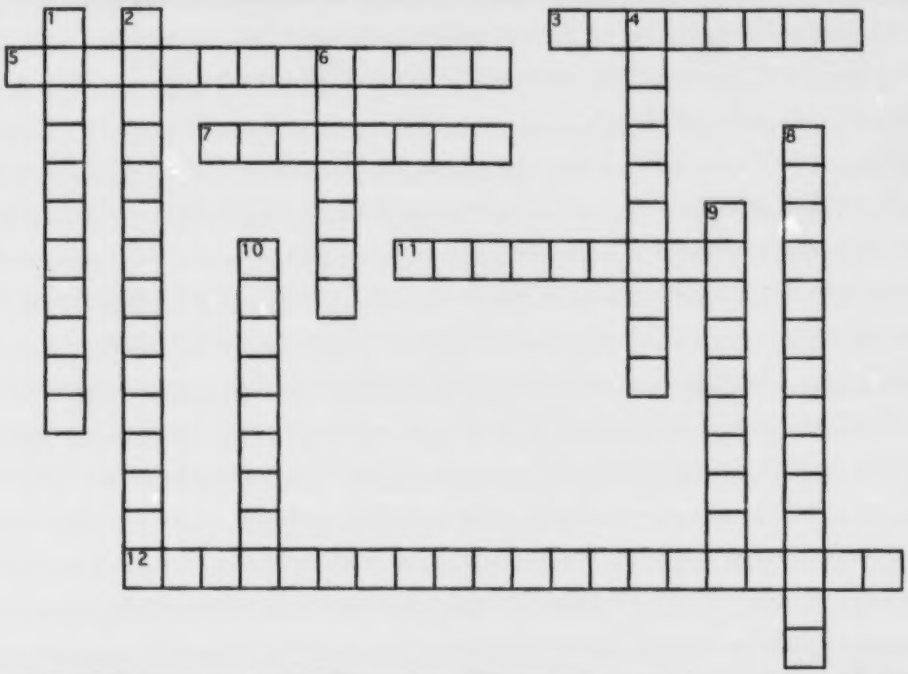
1. The terminal part of the intestine
2. The _____ vein is one of a pair of the longest veins in the body that courses through the leg and thigh before ending in the femoral vein; the vein drains blood from the dorsum of the foot to the femoral vein just below the inguinal ligament (2 words)
9. The _____ vein in the lower body returns blood from the rectum, the sigmoid, and descending parts of the colon (2 words)
12. The portion of the systemic circulation system that provides the pathway of blood flow from the gastrointestinal tract and spleen to the liver via the portal vein and its tributaries is the _____ circulation system
13. Of or relating to the two chief veins of the legs

DOWN

1. To branch into two or more parts, such as a branch of a nerve or artery
3. The _____ vein is a tributary of the portal vein that drains blood from the small intestine, the cecum, and the ascending and the transverse colon (2 words)
4. Curved like the letter C; the portion of the colon that extends from the end of the descending colon in the pelvis to the juncture of the rectum
5. The _____ vein is one of two veins on the left and right side of the body that are the sources of the inferior vena cava and drains blood from the pelvis and the legs (2 words)
6. The pouch at the beginning of the large intestine
7. The upper surface of an appendage or part
8. The _____ vein is a large vein in the thigh that drains blood from the area of the thigh
10. Any one of the sites on the surface of the body where arterial pulsations can be easily felt (2 words)
11. Of or relating to or situated in the region of the groin or in either of the lowest lateral regions of the abdomen

Crossword Puzzle 9—Terms from Objectives 20 Through 24

Name _____ Date _____



ACROSS

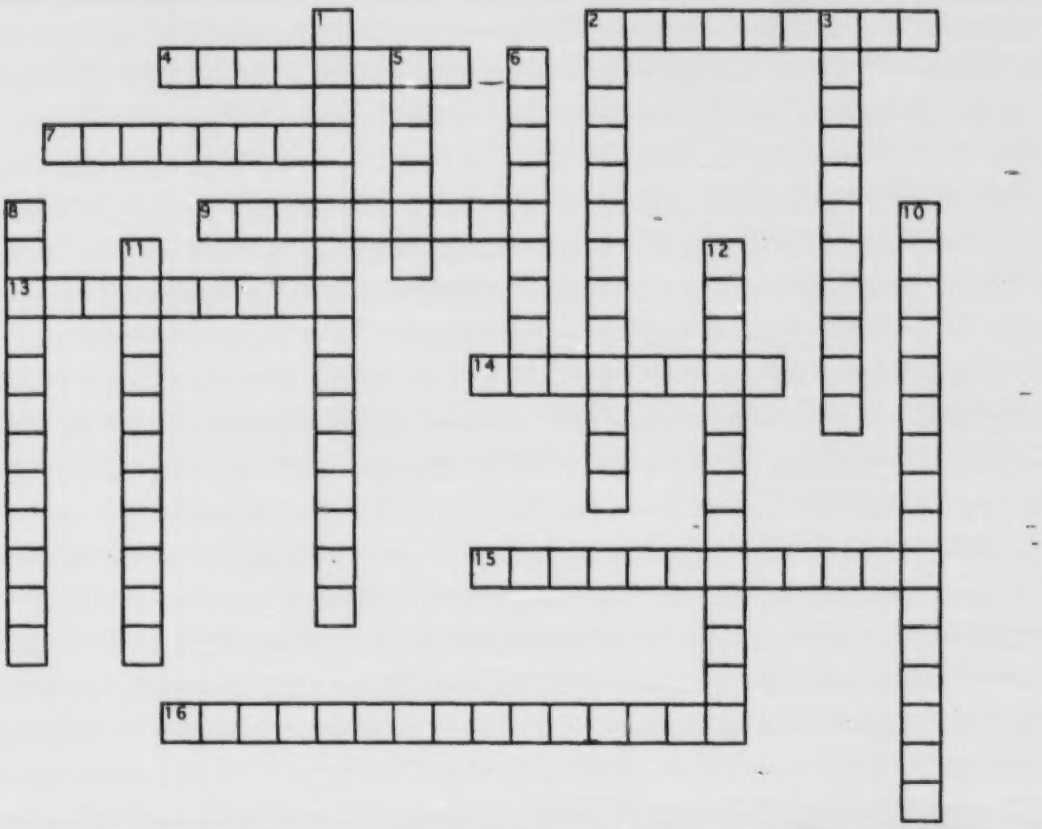
3. A factor that influences blood pressure; as the body uses _____ to constrict the blood vessels, blood pressure increases
5. The pressure exerted by the circulating volume of blood on the walls of the arteries, the veins, and the chambers of the heart (2 words)
7. The second point given in stating blood pressure
11. A factor that influences blood pressure; as the heart beats faster, _____ increases and blood pressure is reduced (2 words)
12. A factor that influences blood pressure; blood pressure increases as _____ is lost as a person ages (3 words)

DOWN

1. A factor that influences blood pressure; as _____ decreases when a person experiences internal bleeding, blood pressure decreases (2 words)
2. The heart rate of a healthy adult at rest is between 60 to 80 beats per minute and is called the _____ (3 words)
4. A factor that influences blood pressure; blood pressure increases as peripheral vascular _____ increases when there is a greater amount of capillaries or other narrow vessels
6. The first point given in stating blood pressure
8. A factor that influences blood pressure; as _____ grows thinner, blood pressure decreases (2 words)
9. A factor that influences blood pressure; as abnormally hard heart contractions lead to increased _____, blood pressure increases (2 words)
10. A factor that influences blood pressure; as _____ that are a by-product of other physiological effects increase, blood pressure increases

Crossword Puzzle 10—Terms from Objectives 25 and 26

Name _____ Date _____



ACROSS

2. The _____ blood vessels of the fetal circulation system consist of one vein
4. A localized sac or bubble that forms at a weak spot in the wall of a blood vessel
7. _____ veins are abnormally large, dilated veins that typically occur in the legs and are caused by congenitally defective valves, phlebitis, pregnancy, and obesity
9. The _____ blood vessels of the fetal circulation system consist of two arteries
13. Inflammation of a vein that is often accompanied by the formation of a clot; also called *thrombophlebitis*
14. A special organ that forms in the uterus during pregnancy, serves as the site of exchange between the mother's blood and the fetus' blood, and consists of tissue from both the mother and the fetus
15. The opening between the right and left atria of the fetal heart that allows some blood to flow to the left atrium (2 words)
16. A common arterial disorder characterized by yellowish plaque in the inner layers of the walls of large- and medium-sized arteries, causing the vessel walls to thicken and narrow, resulting in reduced blood flow to organs normally supplied by the artery

DOWN

1. A common arterial disorder characterized by thickening and loss of elasticity, resulting in a decreased blood supply, especially to the cerebrum and the lower extremities
2. A sheath that covers the umbilical blood vessels (2 words)
3. The general term for any of the various conditions that result in decreased cardiac output and the deprivation of oxygen and nutrients to tissues is called _____ *shock*
5. Circulatory shock that occurs as a result of a bacterial infection is called _____ *shock*
6. _____ arteries are branches of the fetus' internal iliac arteries that allow deoxygenated fetal blood to flow to the placenta, where it becomes enriched with oxygen and nutrients
8. A condition in which blood pressure is consistently higher than 140/90 millimeters of mercury
10. A special fetal blood vessel that diverts blood to the body and away from the fetal lungs, which are collapsed during gestation; constricts as pulmonary flow increases (2 words)
11. A condition caused by abnormally dilated veins in the anal canal
12. A fetal blood vessel that venous blood flows through to the heart and into the inferior vena cava (2 words)

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. TUNICA ADVENTITIA
7. CAPILLARIES
8. VENULES
9. SYSTEMIC
11. TUNICA MEDIA

DOWN
2. ARTERIES
3. VASCULAR SYSTEM
4. ARTERIOLES
5. VEINS
6. TUNICA INTIMA
10. TUNICA

Crossword Puzzle 2

ACROSS
1. ILIAC
6. VASA VASORUM
8. INNOMINATE
13. ARTERIES
14. CAROTID
16. POPLITEAL
17. BIFURCATION

DOWN
2. INNOMINATE
3. ASCENDING
4. AORTA
5. PULMONARY
7. TUNICA INTIMA
9. SUBCLAVIAN
10. POSTERIOR TIBIAL
11. DESCENDING
12. FEMORAL
15. AORTIC ARCH

Crossword Puzzle 3

ACROSS
1. RIGHT SUBCLAVIAN
6. LEFT CAROTID
8. BRACHIAL
10. RADIAL

DOWN
1. RIGHT CAROTID
2. LEFT SUBCLAVIAN
3. AXILLARY
4. RADIAL
5. ULNAR
7. AXILLARY
8. BRACHIAL
9. ULNAR

Crossword Puzzle 4

ACROSS
1. BRONCHIAL
4. ESOPHAGEAL
8. ESOPHAGEAL
9. INTERCOSTAL
11. SUPERIOR PHRENIC
15. CELIAC
16. SPLENIC
17. MEDIASTINAL

DOWN
1. BRONCHIAL
2. MEDIASTINAL
3. CELIAC
5. PERICARDIAL
6. PHRENIC
7. PERICARDIAL
10. INTERCOSTAL
12. HEPATIC
13. SPLENIC
14. HEPATIC

Crossword Puzzle 5

ACROSS
2. INFERIOR MESENTERIC
8. TESTICULAR
9. LEFT GASTRIC
11. OVARIAN
12. RENAL
13. MESENTERIC
14. OVARIAN

DOWN
1. INFERIOR PHRENIC
3. RENAL
4. SUPERIOR MESENTERIC
5. LUMBAR
6. GASTRIC
7. MIDDLE SUPRARENAL
10. TESTICULAR

Crossword Puzzle 6

ACROSS
5. FEMORAL
7. COCCYX
8. INTERNAL ILIAC
9. EXTERNAL ILIAC
12. MIDDLE SACRAL
13. LUMBAR

DOWN
1. POPLITEAL
2. COMMON ILIAC
3. TIBIAL
4. TIBIAL
5. FEMORAL
6. POPLITEAL
10. PSOAS
11. SACRAL

Crossword Puzzle 7

ACROSS
1. SUPERIOR VENA CAVA
6. INNOMINATE
8. CAPILLARIES
11. JUGULAR
14. INTERNAL JUGULAR
15. PORTAL

DOWN
2. INFERIOR VENA CAVA
3. VEINS
4. AXILLARY
5. PULMONARY
7. LONG THORACIC
9. EXTERNAL JUGULAR
10. SUBCLAVIAN
12. SPLENIC
13. HEPATIC

Crossword Puzzle 8

ACROSS
1. RECTUM
2. GREAT SAPHENOUS
9. INFERIOR MESENTERIC
12. PORTAL
13. SAPHENOUS

DOWN
1. RAMIFY
3. SUPERIOR MESENTERIC
4. SIGMOID
5. COMMON ILIAC
6. CECUM
7. DORSUM
8. FEMORAL
10. PULSE POINT
11. INGUINAL

Crossword Puzzle 9

ACROSS
3. HORMONES
5. BLOOD PRESSURE
7. DIASTOLE
11. HEART RATE
12. ELASTICITY OF ARTERIES

DOWN
1. BLOOD VOLUME
2. NORMAL PULSE RATE
4. RESISTANCE
6. SYSTOLE
8. BLOOD VISCOSITY
9. HEART FORCE
10. CHEMICALS

Crossword Puzzle 10

ACROSS
2. UMBILICAL
4. ANEURYSM
7. VARICOSE
9. UMBILICAL
13. PHLEBITIS
14. PLACENTA
15. FORAMEN OVALE
16. ATHEROSCLEROSIS

DOWN
1. ARTERIOSCLEROSIS
2. UMBILICAL CORD
3. CIRCULATORY
5. SEPTIC
6. UMBILICAL
8. HYPERTENSION
10. DUCTUS ARTERIOSUS
11. HEMORRHOIDS
12. DUCTUS VENOSUS

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 5

1. The tunica adventitia of an artery is composed of _____.
   a. endothelium
   b. fibrous connective tissue
   c. elastic connective tissue
   d. involuntary muscle tissue

Objective 2

2. Which of the following is NOT a major structure of the vascular system?
   a. arteries and arterioles
   b. capillaries and venules
   c. venules and veins
   d. visceral organs and tissues

Objective 7

3. Arteries branch into _____.
   a. arterioles and capillaries
   b. venules and capillaries
   c. arterioles and venules
   d. arterioles, venules, and capillaries

Objective 8

4. The ascending aorta _____.
   a. begins at the left ventricle and rises upward
   b. branches into the left and right coronary arteries
   c. both "a" and "b"
   d. neither "a" nor "b"

Objective 12

5. The innermost tissue layer of a vein is composed of _____.

   a. endothelium

   b. epithelial tissue

   c. connective tissue

   d. muscle tissue

Objective 5

6. The tunica media of an artery is composed of _____.

   a. endothelium

   b. involuntary muscle tissue

   c. both "a" and "b"

   d. neither "a" nor "b"

Objective 1

7. The portion of the cardiovascular system that deals with the blood vessels that allow for circulation throughout the body is the _____.

   a. vascular system

   b. systemic circulation system

   c. circulatory system

   d. portal circulation system

Objective 6

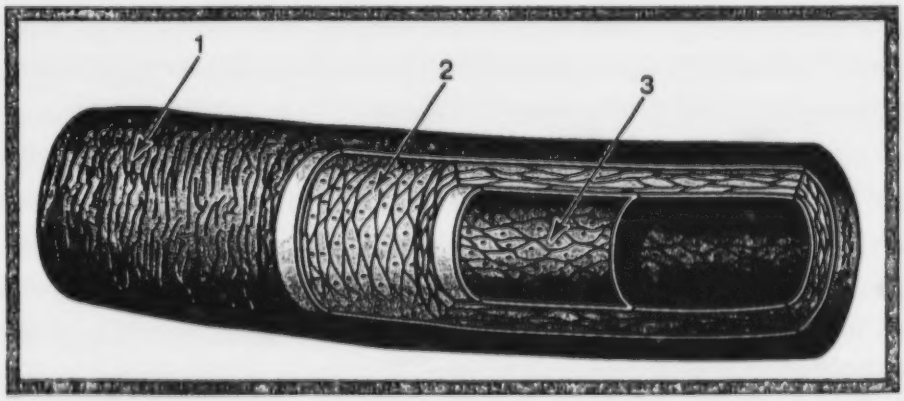
8. In the illustration below, what is the correct labeling of the tissue layers of an artery?

   a. (1) tunica intima, (2) tunica media, (3) tunica adventitia

   b. (1) tunica media, (2) tunica adventitia, (3) tunica intima

   c. (1) tunica adventitia, (2) tunica intima, (3) tunica media

   d. (1) tunica adventitia, (2) tunica media, (3) tunica intima



Objective 7

9. Which of the following statements about arteries is NOT correct?

   a. Most arteries carry oxygenated blood away from the heart, beginning with the aorta.

   b. The pulmonary artery carries deoxygenated blood from the heart to the lungs.

   c. Many arteries are referred to by different names as they pass through various areas of the body.

   d. Many arteries contain valves that prevent the backflow of blood.

Objective 3

10. The circulation system that supplies those parts of the body that receive blood through the aorta rather than through the pulmonary artery is the _____.

   a. vascular system

   b. systemic circulation system

   c. circulatory system

   d. portal circulation system

Objective 7

11. The outer layers of arteries are supplied with oxygen and nutrients by a network of small blood vessels called the _____.

   a. *arterioscelorum*

   b. *vasa majorum*

   c. *arterius arteriorum*

   d. *vasa vasorum*

Objective 25

12. The fetus depends on the mother for _____.

   a. circulation of blood

   b. the intake of oxygen and nutrients

   c. the removal of carbon dioxide and waste products

   d. all of the above

Objective 8

13. The _____ is the main trunk of the systemic arterial circulation system.

   a. aorta

   b. ascending aorta

   c. aortic arch

   d. descending aorta

Objective 4

14. Which of the following is the correct sequence of blood circulation through the major structures of the systemic circulation system?

    a. heart, arteries, arterioles, capillaries, venules, veins

    b. heart, veins, venules, capillaries, arterioles, arteries

    c. heart, arterioles, arteries, capillaries, venules, veins

    d. heart, arteries, arterioles, capillaries, veins, venules

Objective 25

15. The umbilical blood vessels consist of _____.

    a. one vein and one artery

    b. two veins and one artery

    c. one vein and two arteries

    d. two veins and two arteries

Objective 8

16. The _____ artery is sometimes called the *brachiocephalic artery*.

    a. carotid

    b. iliac

    c. innominate

    d. subclavian

Objective 23

17. The systole is the contraction of the _____, which in ventricular contraction, causes blood to be pumped into the arteries.

    a. endocardium

    b. myocardium

    c. cavities of the heart

    d. thorax

Objective 8

18. The descending aorta is a continuation of the _____ that turns downward.

    a. innominate artery

    b. left common carotid artery

    c. left subclavian artery

    d. aortic arch

Objective 23

19. Blood pressure of a healthy young adult is approximately _____.

    a. 90 mm Hg in diastole

    b. 120 mm Hg during systole

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 17

20. The portion of the systemic circulation system that provides the pathway of blood flow from the gastrointestinal tract and spleen to the liver is the _____ circulation system.

    a. vascular

    b. portal

    c. pulmonary

    d. gastric

Objective 9

21. Which of the following is NOT an organ served by the celiac artery?

    a. stomach

    b. liver

    c. spleen

    d. kidneys

Objective 24

22. The body uses _____ to help regulate blood pressure, often by constricting or relaxing the blood vessels.

    a. chemicals

    b. hormones

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 9

23. The colon and rectum—except for right half of transvere colon—are supplied by the _____ artery.

    a. internal iliac

    b. external iliac

    c. inferior mesenteric

    d. superior mesenteric

Objective 25

24. Materials move between the mother's and the fetal circulatory systems by _____.

a. diffusion through the walls of the blood vessels

b. active-transport mechanisms

c. both "a" and "b"

d. neither "a" nor "b"

Objective 24

25. Increased heart rate results in _____.

a. increased heart force

b. decreased heart force

c. higher blood pressure

d. lower blood pressure

Objective 9

26. The _____ artery branches supply the lymph glands and the posterior mediastinum.

a. mediastinal

b. intercostal

c. superior/phrenic

d. pericardial

Objective 25

27. _____ blood flows from the placenta to the fetus in the umbilical vein.

a. Deoxygenated

b. Enriched

c. both "a" and "b"

d. neither "a" nor "b"

Objective 9

28. The _____ is the branch of the celiac artery that supplies the liver.

a. splenic

b. gastric

c. hepatic

d. lumbar

Objective 26

29. Hemorrhoids are _____.

a. abnormally large, dilated veins that typically occur in the legs

b. abnormally large, dilated arteries that typically occur in the legs

c. both "a" and "b"

d. neither "a" nor "b"

Objective 25

30. The fetal heart contains an opening between the right and left atria called the *foramen* _____.

a. *magnum*

b. *ovale*

c. *vena-caval*

d. *spinosum*

Objective 11

31. Capillaries _____ arterioles and venules.

a. separate

b. grow into

c. connect

d. provide nervous-system inputs to

Objective 15

32. The _____ vein ramifies in the liver.

a. superior mesenteric

b. inferior mesenteric

c. common iliac

d. portal

Objective 11

33. Nutrients, oxygen, and cell metabolic wastes pass through the capillary walls by _____.

a. hydrophilic pressure

b. hydrophobic pressure

c. osmosis

d. stenosis

Objective 10

34. The artery indicated by the letter "W" in the illustration on the next page is the _____.

    a. aortic arch
    b. innominate artery
    c. right subclavian artery
    d. right carotid artery

Objective 10

35. The artery indicated by the letter "X" in the illustration on the next page is the _____.

    a. right common iliac artery
    b. left common iliac artery
    c. popliteal artery
    d. posterior tibial artery

Objective 10

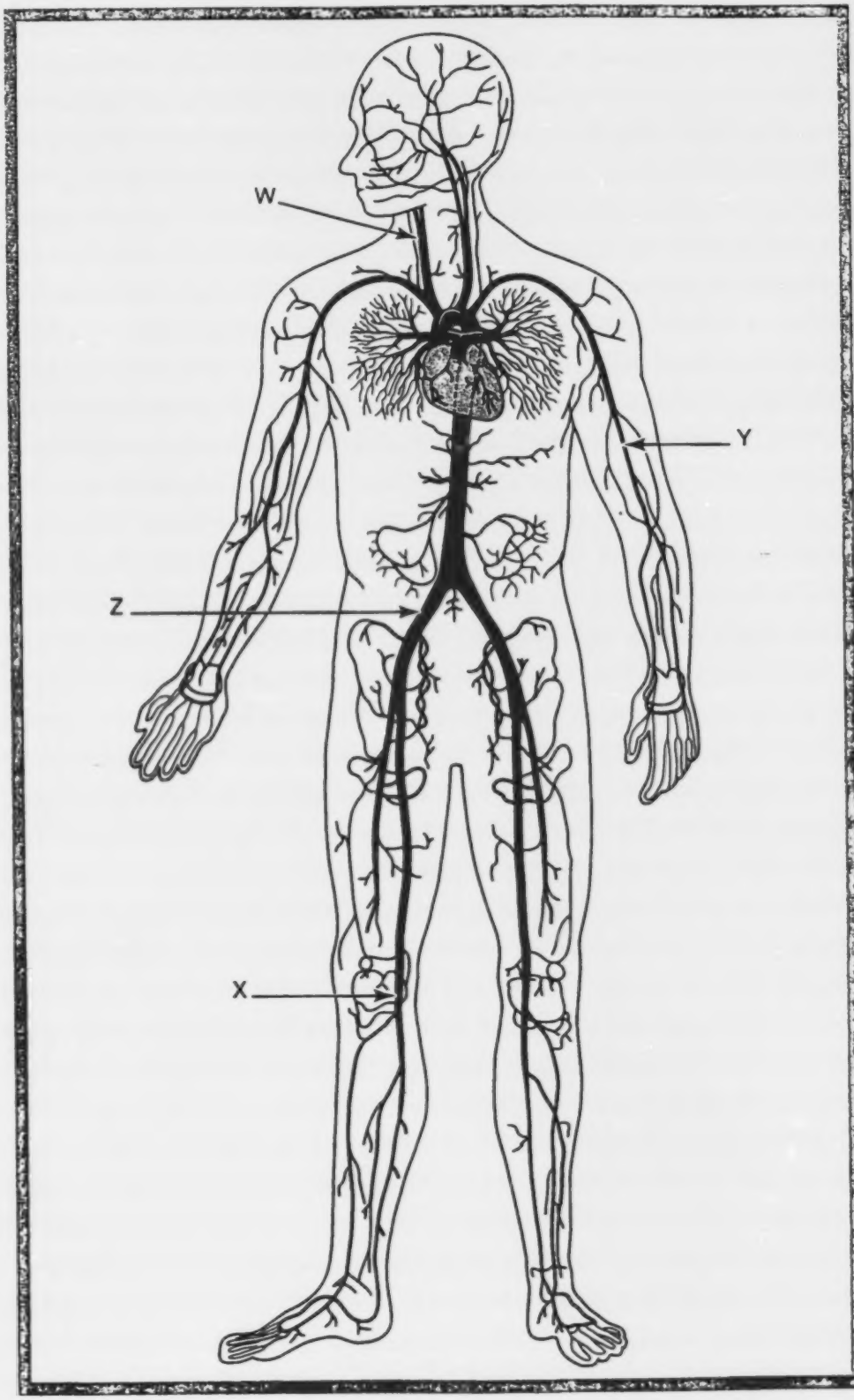
36. The artery indicated by the letter "Y" in the illustration on the next page is the _____.

    a. axillary artery
    b. brachial artery
    c. radial artery
    d. ulnar artery

Objective 10

37. The artery indicated by the letter "Z" in the illustration on the next page is the _____.

    a. abdominal aorta
    b. right common iliac artery
    c. renal artery
    d. splenic


W
Y
Z
X

Objective 25

38. Blood enters the _____ of the fetal heart.

a. right ventricle

b. left ventricle

c. right atrium

d. left atrium

Objective 12

39. The middle tissue layer of a vein is composed of _____.

a. endothelium

b. epithelial tissue

c. connective tissue

d. muscle tissue

Objective 13

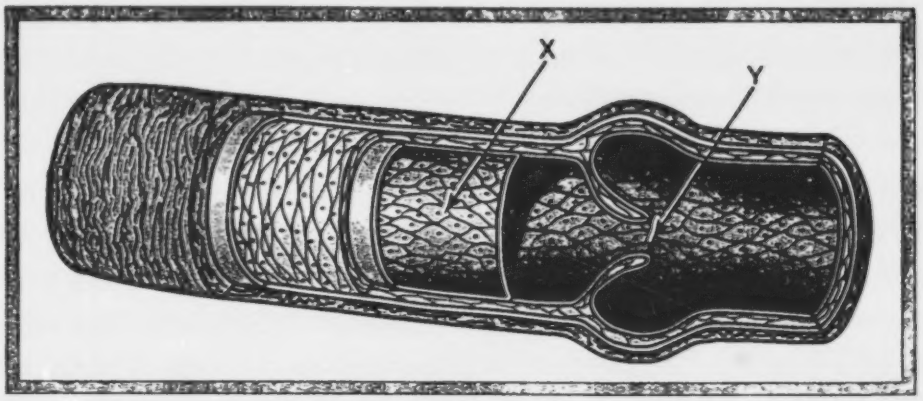
40. What structure of a vein is indicated by the letter "X" in the illustration below?

a. tunica intima

b. tunica media

c. tunica adventitia

d. valve



Objective 13

41. What structure of a vein is indicated by the letter "Y" in the illustration above?

a. connective tissue

b. valve

c. endothelium

d. muscle tissue

Objective 15

42. The right, middle, and left hepatic veins drain the blood of the liver into the _____.

a. superior vena cava

b. inferior vena cava

c. innominate vein

d. subclavian vein

Objective 14

43. The _____ carry oxygenated blood from the lungs to the heart.

a. vena cava and vena superior

b. aorta and descending aorta

c. pulmonary arteries

d. pulmonary veins

Objective 25

44. A special fetal blood vessel called the _____ diverts blood to the body and away from the fetal lungs.

a. *fetal pulmonary*

b. *fetal coronary*

c. *ductus venosus*

d. *ductus arteriosus*

Objective 14

45. Veins branch into _____.

a. arterioles and capillaries

b. venules and capillaries

c. arterioles and venules

d. arterioles, venules, and capillaries

Objective 5

46. The tunica intima of an artery is composed of _____.

a. endothelium

b. fibrous connective tissue

c. elastic connective tissue

d. involuntary muscle tissue

Objective 18

47. Which of the following statements is NOT correct with regard to portal circulation?

a. Veins from the stomach, intestines, spleen, and pancreas empty into the portal vein.

b. The portal vein carries the blood loaded with digested food products to the liver, where the food is altered, stored, and released as needed.

c. The liver removes toxins from the blood.

d. Blood leaves the liver through the portal veins, which empty into the inferior vena cava.

Objective 15

48. The _____ vein is one of a pair of the longest veins in the body that courses through the leg and thigh.

a. common iliac

b. femoral

c. great saphenous

d. inferior mesenteric

Objective 11

49. Capillary walls are _____ in thickness.

a. one cell layer

b. two cell layers

c. three cell layers

d. four cell layers

Objective 14

50. Most veins carry deoxygenated blood back to the heart, ending in the _____.

a. vena cava

b. vena superior

c. aorta

d. descending aorta

Objective 25

51. As blood stops flowing through them, the special fetal blood vessels _____.

a. dilate

b. constrict

c. merge with other blood vessels

d. provide bypass routes in the event that normal vessels become injured or diseased

Objective 15

52. The _____ is formed by the union of the internal jugular and subclavian veins and drains blood from the head, neck, and upper extremities.

a. superior vena cava

b. inferior vena cava

c. innominate vein

d. axillary vein

Objective 8

53. The descending aorta ends near the fourth lumbar vertebra at the aortic bifurcation, forming the _____.

a. aortic termination

b. abdominal aorta

c. left and right femoral arteries

d. left and right common iliac arteries

Objective 15

54. The _____ is the large vein of the body that returns deoxygenated blood from the upper half of the body to the right atrium.

a. superior vena cava

b. inferior vena cava

c. innominate vein

d. subclavian vein

Objectives 22 & 23

55. Which of the following statements is NOT true concerning blood pressure?

a. Blood pressure is the pressure exerted by the circulating volume of blood on the walls of the arteries, the veins, and the chambers of the heart.

b. Blood pressure is created by the contraction of the ventricles in the heart.

c. The conventional measure of blood pressure is in centimeters of mercury.

d. Blood-pressure measurement is a measure of the force required to raise a column of liquid mercury in a tube.

Objective 8

56. The aortic arch is a continuation of the aorta that _____.

a. turns backward and to the left at the level of the fourth thoracic vertebra

b. turns backward and to the left at the level of the second thoracic vertebra

c. turns backward and to the right at the level of the fourth thoracic vertebra

d. turns backward and to the right at the level of the second thoracic vertebra

Objective 23

57. The diastole is the dilation of the _____ during which they fill with blood.

a. cavities of the heart

b. lungs

c. arteries of the heart

d. veins of the heart

Objective 8

58. The descending aorta, as it passes through the thoracic cavity, becomes the _____.

a. aortic termination

b. abdominal aorta

c. both "a" and "b"

d. neither "a" nor "b"

Objective 23

59. Blood-pressure measurement is always given _____.

a. stating the systole first

b. stating the diastole first

c. during systole

d. during diastole

Objective 21

60. The pulse point indicated by the letter "X" in the illustration on the next page is the _____ artery.

a. popliteal

b. posterior tibial

c. radial

d. femoral

Objective 21

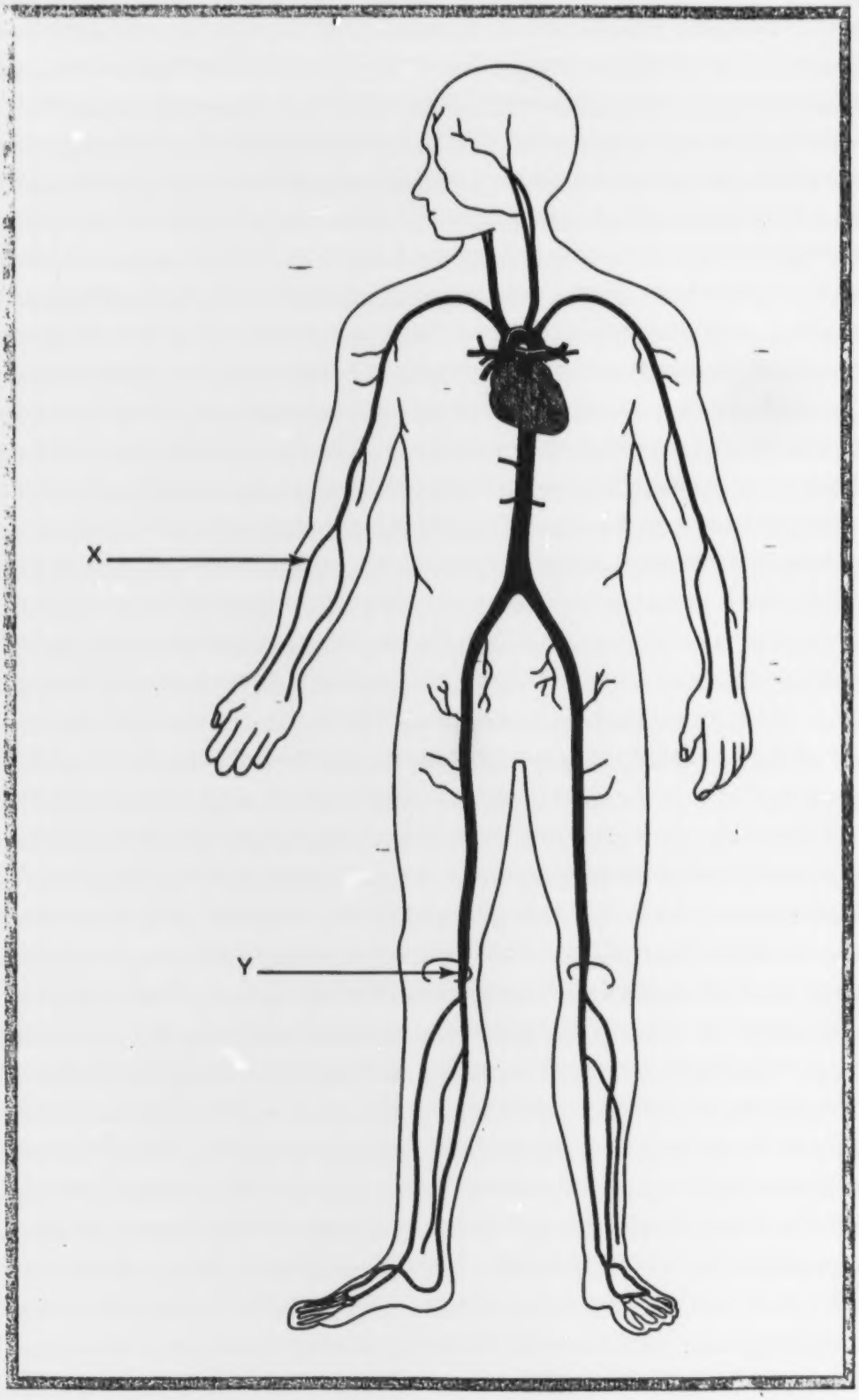
61. The pulse point indicated by the letter "Y" in the illustration on the next page is the _____ artery.

a. popliteal

b. posterior tibial

c. radial

d. femoral


X
Y

Objectives 19 & 20

62. Which of the following statements is NOT correct with regard to the pulse and pulse points?

    a. The pulse points are the sites on the surface of the body where vein pulsations can be easily felt.

    b. The pulse points are the sites on the surface of the body where arterial pulsations can be easily felt.

    c. Normal pulse rate is between 60 to 80 beats per minute.

    d. At the pulse points, vibrations can be felt where arteries are near the surface of the body.

Objective 16

63. The major vein of the systemic circulation system that is indicated by the letter "X" in the illustration on the next page is the _____.

    a. right common iliac

    b. left common iliac

    c. superior mesenteric

    d. inferior mesenteric

Objective 16

64. The major vein that is indicated by the letter "Y" in the illustration on the next page is the _____.

    a. axillary

    b. left subclavian

    c. left innominate

    d. right subclavian

Objective 16

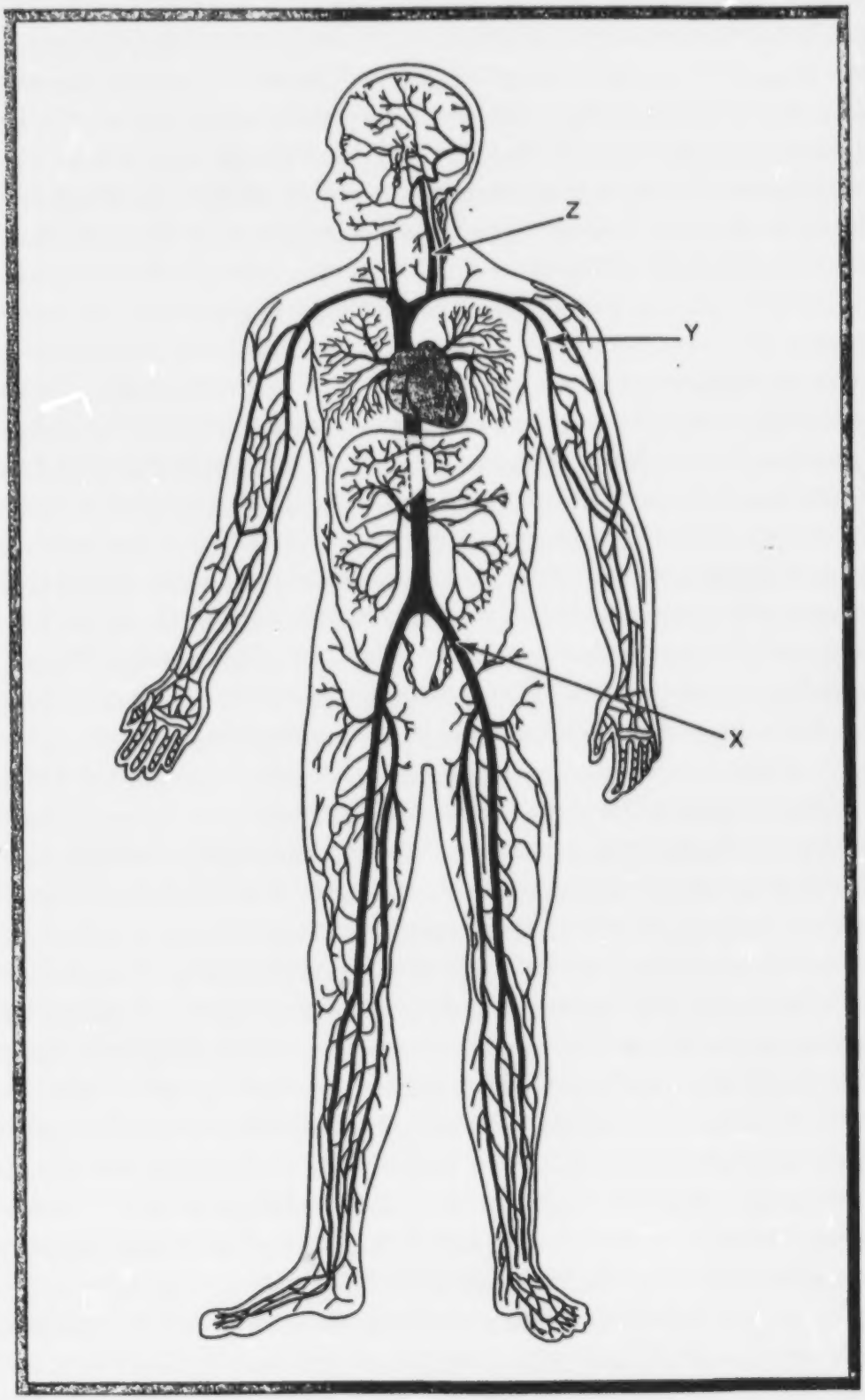
65. The major vein that is indicated by the letter "Z" in the illustration on the next page is the _____.

    a. axillary

    b. left subclavian

    c. left innominate

    d. right subclavian


Z
Y
X

Objective 9

66. The _____ arteries branch from the bifurcation of the descending aorta and supply the areas of the body near the ilium.

a. internal iliac

b. right and left common iliac

c. external iliac

d. tibial

Objective 24

67. If the blood thickens, blood pressure will _____; if the blood grows thinner, blood pressure will _____.

a. increase; decrease

b. decrease; increase

c. stabilize; destabilize

d. destabilize; stabilize

Objective 9

68. The left and right sides of the head, neck, and brain are supplied by the _____ arteries.

a. carotid

b. subclavian

c. superior phrenic

d. inferior phrenic

Objective 7

69. The tunica intima of an artery _____.

a. causes the artery to stand open when cut

b. causes the artery to seal shut when cut

c. permits constriction and dilation of the artery

d. prevents constriction and dilation of the artery

Objective 25

70. In the placenta, the mother's blood vessels and those of the fetus _____.

a. join veins to veins and arteries to arteries

b. join veins to arteries and arteries to veins

c. come very close to each other

d. do not get very near to each other

Objective 9

71. The _____ arteries from the abdominal aorta supply the diaphragm and esophagus.

a. mesenteric

b. renal

c. lumbar

d. inferior phrenic

Objective 25

72. The placenta is joined to the fetus by the _____.

a. umbilical cord

b. placental artery

c. placental vein

d. fetal ligament

Objective 8

73. On the right side, the aortic arch branches into the _____.

a. left innominate vein

b. left common carotid artery

c. both "a" and "b"

d. neither "a" nor "b"

Objective 25

74. The umbilical _____ and allow deoxygenated fetal blood to flow to the placenta where it becomes enriched with oxygen and nutrients.

a. arteries are branches of the fetus' internal iliac arteries

b. veins are branches of the fetus' external iliac veins

c. artery is a branch of the fetus' external iliac artery

d. vein is a branch of the fetus' internal iliac veins

Objective 9

75. The _____ branches of the abdominal artery supply the adrenal glands.

a. middle renal

b. middle suprarenal

c. inferior renal

d. inferior suprarenal

Objective 10

76. The artery indicated by the letter "W" in the illustration on the next page is the _____.

a. right carotid artery
b. right subclavian artery
c. innominate artery
d. right coronary artery

Objective 10

77. The artery indicated by the letter "X" in the illustration on the next page is the _____.

a. abdominal aorta artery
b. right common iliac artery
c. right coronary artery
d. innominate artery

Objective 10

78. The artery indicated by the letter "Y" in the illustration on the next page is the _____.

a. radial artery
b. renal artery
c. left common iliac artery
d. ulnar artery

Objective 10

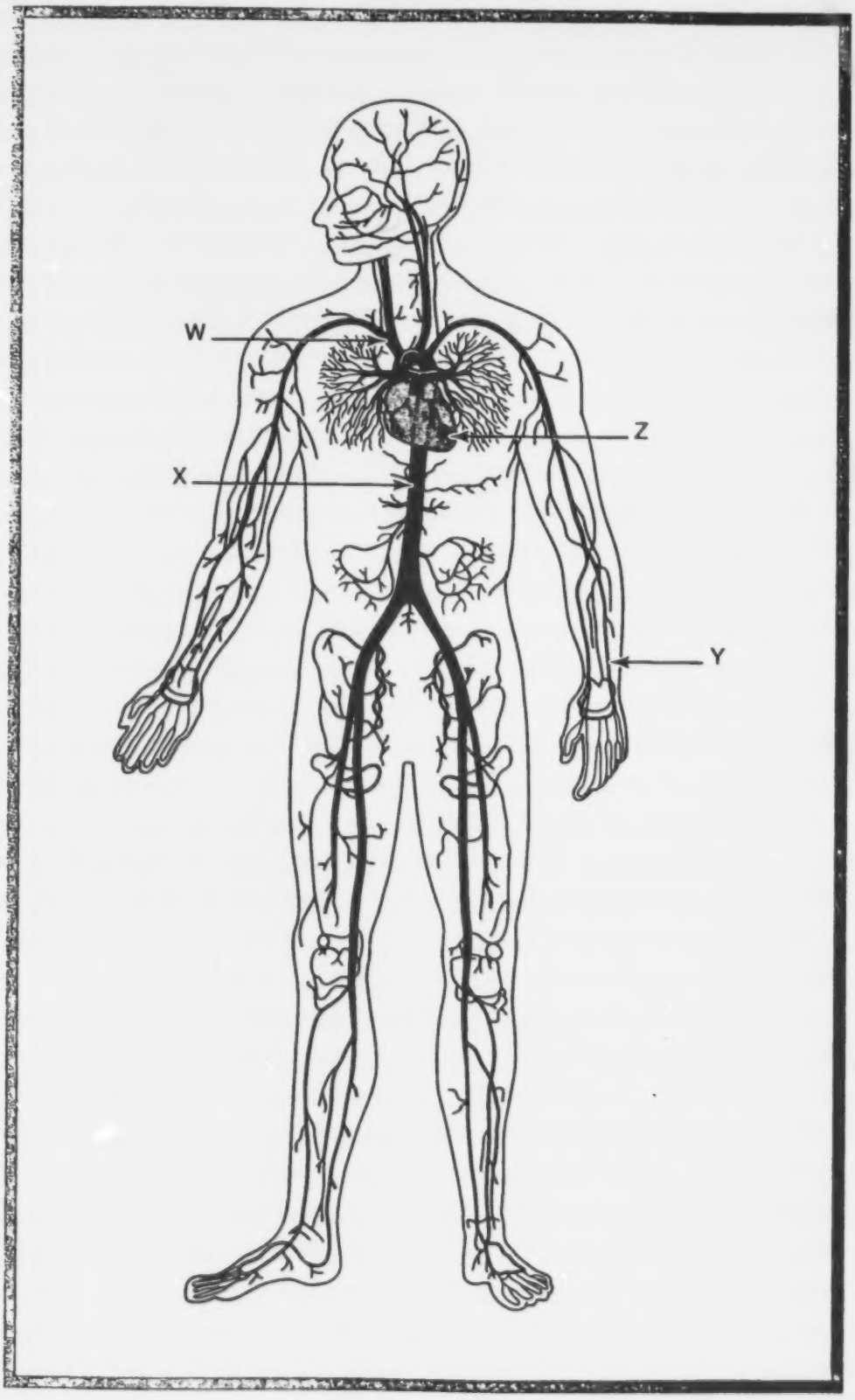
79. The artery indicated by the letter "Z" in the illustration on the next page is the _____.

a. axillary artery
b. right coronary artery
c. left coronary artery
d. brachial artery

Objective 14

80. Which of the following is NOT a true statement about veins?

a. The middle layer of a vein is not well developed or very flexible.
b. The walls of a vein are relatively thick so that veins do not collapse when cut.
c. Many veins contain valves that prevent the backflow of blood.
d. Many veins share their names with the corresponding arteries.


W
Z
X
Y

Objective 21

81. The pulse point indicated by the letter "X" in the illustration on the next page is the _____ artery.

a. facial

b. superficial temporal

c. brachial

d. radial

Objective 21

82. The pulse point indicated by the letter "Y" in the illustration on the next page is the _____ artery.

a. radial

b. brachial

c. femoral

d. popliteal

Objective 21

83. The pulse point indicated by the letter "Z" in the illustration on the next page is the _____ artery.

a. popliteal

b. posterior tibial

c. dorsalis pedis

d. femoral

Objective 25

84. Some of the venous blood flows to the fetal liver, but most flows to the _____ through the _____.

a. heart; ductus venosus

b. heart; superior vena cava

c. lungs; ductus venosus

d. lungs; superior vena cava

Objective 12

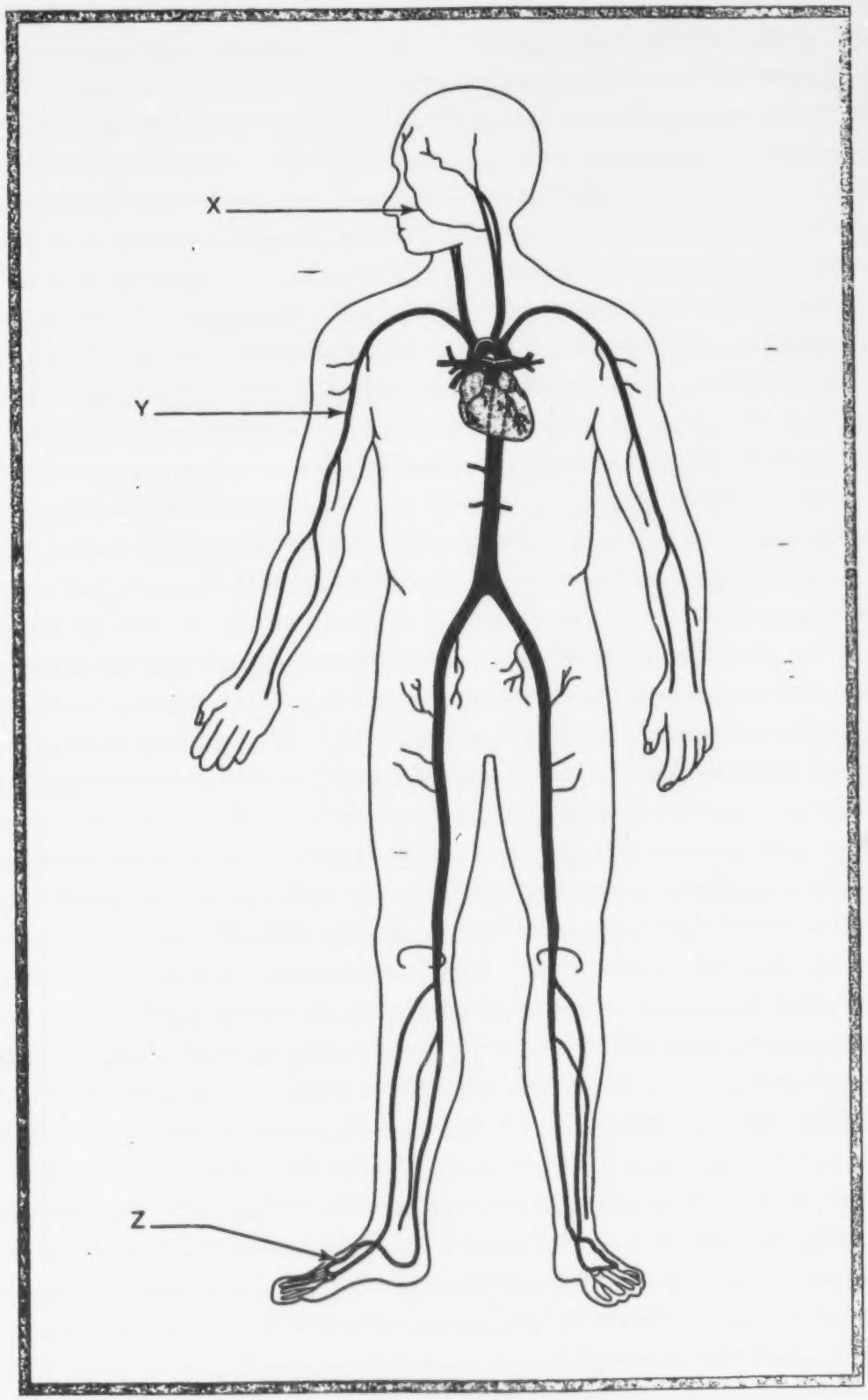
85. The external tissue layer of a vein is composed of _____.

a. endothelium

b. epithelial tissue

c. connective tissue

d. muscle tissue


X
Y
Z

Objective 16

86. The major vein of the systemic circulation system that is indicated by the letter "X" in the illustration on the next page is the _____.

a. right subclavian

b. internal jugular

c. external jugular

d. right innominate

Objective 16

87. The major vein of the systemic circulation system that is indicated by the letter "Y" in the illustration on the next page is the _____.

a. superior mesenteric

b. inferior vena cava

c. superior vena cava

d. axillary

Objective 16

88. The major vein of the systemic circulation system that is indicated by the letter "Z" in the illustration on the next page is the _____.

a. femoral

b. right common iliac

c. right innominate

d. great saphenous

Objective 9

89. The artery of the forearm that starts at the bifurcation of the brachial artery and supplies the forearm, wrist, and hand is the _____ artery.

a. axillary

b. inferior brachial

c. radial

d. ulnar

Objective 25

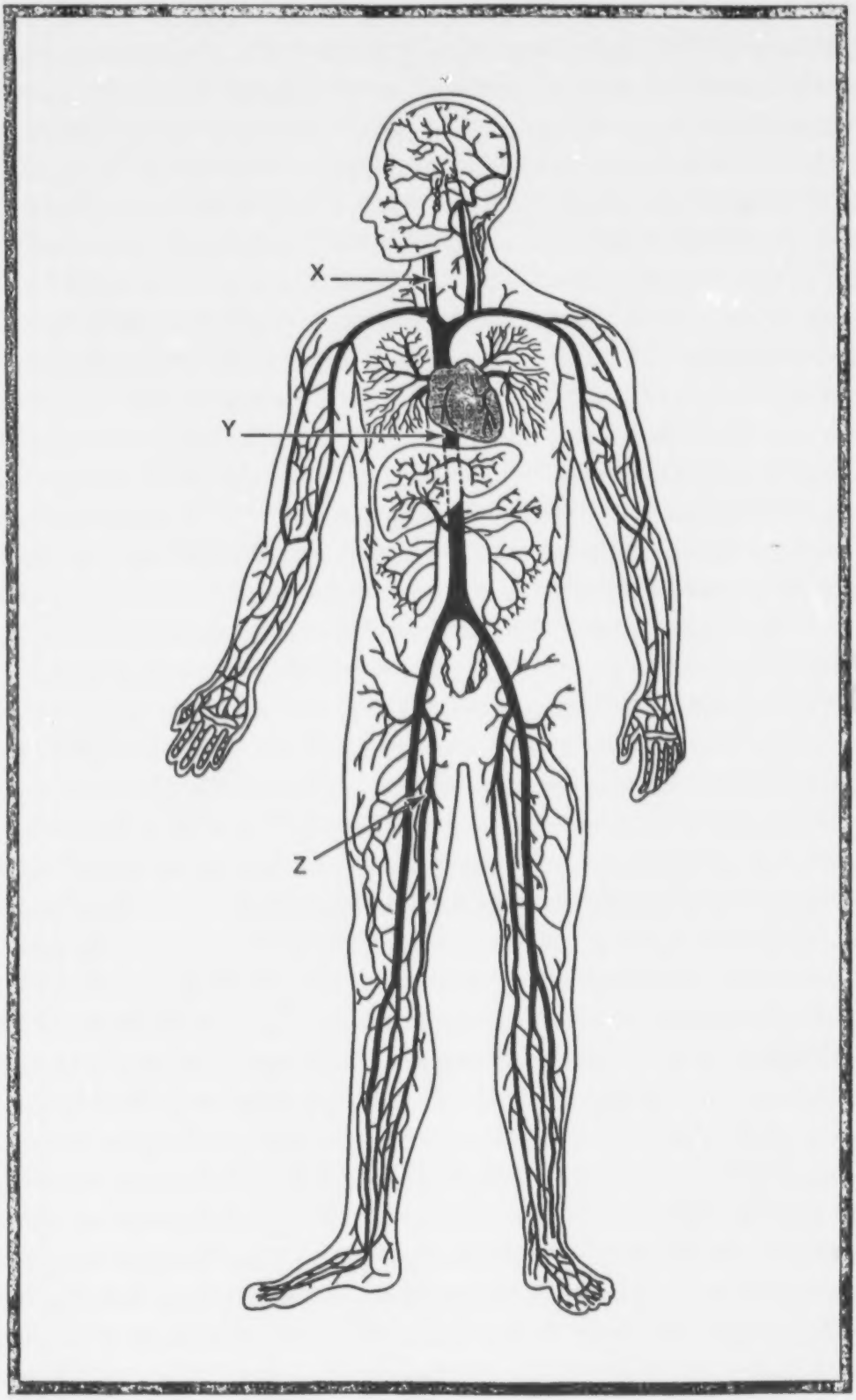
90. The pumping of the fetus' _____ pushes blood into the pulmonary artery.

a. right ventricle

b. left ventricle

c. right atrium

d. left atrium


X
Y
Z

Objective 26

91. An abnormal accumulation of yellowish plaque along the walls of large- and medium-sized arteries is called _____.

    a. *arteriosclerosis*

    b. *atherosclerosis*

    c. *aneurysm*

    d. *phlebitis*

Objective 25

92. Blood returning from the newborn's lungs to the left atrium causes a flap to close over the foramen ovale, which _____.

    a. becomes a bicuspid valve

    b. becomes a tricuspid valve

    c. seals within a few days

    d. seals within a few months

Objective 15

93. One of a pair of large vessels in the neck that receives most of the blood from the exterior of the cranium and the deep tissues of the face is the _____.

    a. superior vena cava

    b. inferior vena cava

    c. internal jugular vein

    d. external jugular vein

Objective 25

94. When the baby begins breathing after delivery, the expansion of the lungs pulls blood _____.

    a. into the pulmonary artery and to the lungs

    b. out of the pulmonary artery and out of the lungs

    c. out of the liver to begin normal circulation

    d. out of the placenta to begin normal circulation

Objective 9

95. The _____ artery is a continuation of the femoral artery that passes through the knee.

    a. internal iliac

    b. external iliac

    c. tibial

    d. popliteal

Objective 8

96. The term _____ is defined as "the point at which something divides into branches or parts."

a. *tunica*

b. *aorta*

c. *bifurcation*

d. *brachial*

Objective 26

97. Septic shock is _____.

a. a general term for various conditions that result in decreased cardiac output and the deprivation of oxygen and nutrients to tissues

b. circulatory shock that occurs as a result of bacterial infection

c. circulatory shock that occurs as a result of food poisoning

d. circulatory shock that occurs as a result of extreme stress or fright

Objective 5

98. *Tunica* is a term meaning _____.

a. the innermost tissue layer of an artery

b. the middle tissue layer of an artery

c. the outermost tissue layer of an artery

d. an enveloping membrane or layer of body tissue

Objective 26

99. Hypertension is a condition in which blood pressure is consistently higher than _____ mm Hg.

a. 130/80

b. 130/90

c. 140/80

d. 140/90

Objective 24

100. Which of the following is NOT likely to influence blood pressure?

a. elasticity of the arteries

b. blood type

c. hormones

d. chemicals

Answers to Module Review

1. b	21. d	41. b	61. a	81. a
2. d	22. c	42. b	62. a	82. b
3. a	23. c	43. d	63. b	83. c
4. c	24. c	44. d	64. a	84. a
5. a	25. d	45. b	65. c	85. c
6. b	26. a	46. a	66. b	86. b
7. a	27. b	47. d	67. a	87. b
8. d	28. c	48. c	68. a	88. d
9. d	29. d	49. a	69. a	89. c
10. b	30. b	50. a	70. c	90. a
11. d	31. c	51. b	71. d	91. b
12. d	32. d	52. c	72. a	92. c
13. a	33. c	53. d	73. d	93. d
14. a	34. d	54. a	74. a	94. a
15. c	35. c	55. c	75. b	95. d
16. c	36. b	56. a	76. c	96. c
17. b	37. b	57. a	77. a	97. b
18. d	38. c	58. d	78. d	98. d
19. b	39. d	59. a	79. c	99. d
20. b	40. a	60. c	80. b	100. b

MODULE SET II:
Major Body Systems

Module 10: Lymphatic System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Lymphatic System	9
2—Major Structures of the Lymphatic System	11
3—Sequence of Lymph Circulation Through the Lymphatic System	13
4—Major Groups of Lymph Nodes	15
5—Area of Drainage of the Major Lymphatic Ducts	17
6—The Tonsils of the Mouth and Throat	19
Written Test	21
Answers to Written Test	33
Answers to Assignment Sheet	37
Crossword Puzzles	
1—Terms from Objectives 1 Through 9	39
2—Terms from Objectives 11 Through 18	41
Answers to Crossword Puzzles	43
Module Review	45
Answers to Module Review	57

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activities Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module is the last of the modules dealing with the circulatory system, with a focus on lymphatics. Use this opportunity to ensure that over the course of presenting these four modules you have presented all of the objectives that are required to cover the system topic.

- Use crossword puzzles 1 and 2 to help reinforce the terms in the associated objectives.
- Review the previous modules on the circulatory system and refresh the students' memories about the immune system. Discuss the role of the lymphatic system in both of these systems.
- To supplement Objective 1 through Objective 3, use illustrations to define the lymphatic system and to discuss the major structures of the lymphatic system. Display preserved specimens of the major structures if available.
- Use the following strategies to supplement Objective 4 and Objective 5.
  - Discuss the characteristics of lymph. Display samples of lymph if available. Discuss factors that influence the appearance of lymph. Discuss why lymph has no red blood cells and less protein than plasma.
  - Use illustrations of the muscular system to discuss how contractions of the muscles provide pumping action to the lymphatic vessels. Discuss lymphedema and compression hose as well as other techniques used to improve lymph circulation. Show illustrations of lymphatic valves and discuss how they work. Trace the flow of lymph through the body. Discuss the role of the circulatory system in disposing of lymph and the wastes carried by lymph. Discuss the use of lymph and associated fluid-drainage mechanisms for certain injuries and surgical procedures.
- To supplement Objective 6, point out lymphatic capillaries in illustrations of the lymphatic system. Discuss their role, structure, and size. Compare and contrast lymphatic capillaries with blood capillaries. View preserved capillaries under magnification, emphasizing the cellular structure.
- Continue the discussion of lymphatic vessels in Objective 7 by following the same approach as used for lymphatic capillaries.
- Use the following strategies to supplement your discussion of Objective 8 through Objective 13.
  - Using illustrations of the lymphatic system, discuss the right lymphatic duct and the thoracic duct. During the discussion, introduce other major vessels and nodes but ensure that you emphasize the drainage patterns. Using an illustration that does not

show drainage patterns, quiz the students over the duct involved for various parts of the lymphatic system.

— If available, display preserved lymph nodes. Also allow the students to palpate swollen nodes. Display imaging or observe the conduct of a dye or radioisotope tracing of lymph-drainage (such as in preparation for a sentinel-node biopsy). Discuss the role of sentinel-node procedures and other surgical procedures associated with nodes. Note the correlation between the names of nodes and their anatomical locations. Recall previous discussions about the immune system and the roles of lymphocytes and monocytes.

— Showing the students illustrations of node locations without labels, ask the students to identify where they believe the cervical, axillary, and inguinal nodes are. Discuss the body areas associated with these nodes. Discuss conditions and surgical procedures that may involve these nodes and body areas, such as breast cancer.

- Use the following strategies to supplement Objective 14 through Objective 17.

— Provide a preserved spleen and slide sections if available. Provide X rays or other images of a patient whose spleen has been removed. Discuss the shift in splenic functions to the liver and bone marrow.

— Discuss the role of the thymus in the fetus, after birth, and during adulthood. Discuss the role of thymosin. Provide a preserved thymus and slide sections if available.

— Discuss the tonsils, locating them on illustrations. Allow students to examine the palatine tonsils of a volunteer. Invite a surgeon to discuss surgical removal of tonsils and adenoids and the evolution of that practice over the past 50 years.

- To supplement Objective 18, discuss common disorders related to the lymphatic system. Invite persons afflicted with these conditions to talk to the class about their symptoms and care.

- For Objective 19, select types of cancer to use in the assignment sheet and make available resources for students to use in doing the assignment.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F.A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F.A. Davis Company, 1999.

- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites offer general information about the lymphatic system.

- A Better Way Teaching Systems

  http://a-better-way.com/systems/10_3.html#ls

  This site provides a short basic overview of the lymphatic system with a good diagram and discussion on immunity.

- American Medical Association (AMA) Atlas of the Body

  http://www.medem.com/MedLB/article_detaillb.cfm?article_ID=ZZZG0S6CGJC&sub_cat=518

  This AMA page offers a short description of the lymphatic system with a diagram of the overall system.

- National Cancer Institute

  http://cancernet.nci.nih.gov/cgi-bin/srchcgi.exe?DBID=pdq&TYPE=search&SFMT=pdq_statement/1/0/0&Z208=208_00442P

  Because of the number of cancer surgeries that may involve removal of lymph nodes, the National Cancer Institute supports this web site about lymphedema and discusses symptoms, diagnosis, treatment, etc.

- Indiana Wesleyan University

  http://199.8.27.201/Courses/bjw-bio112/genesem98/sld001.htm

  This 156-slide presentation on the lymphatic system and immunity mechanisms provides useful information on the structure and functioning of the lymphatic system, its role in immunity, and some of the tools involved in immunology.

- University of Illinois

  http://www.acm.uiuc.edu/sigbio/project/updated-lymphatic/lymphl.html

  This site offers a good general overview of the lymphatic system with links to pages with more-detailed descriptions of the various components of the system.

- Innerbody

  http://www.innerbody.com/image/lympov.html

  This site offers a diagram with a link to a brief description of the lymphatic system. Other pages on the site provide illustrations and animations for other anatomical systems.

- The Lymphoma Information Network

  http://www.lymphomainfo.net/lymphoma/lymphsys.html

  This site focuses on diseases of the lymphatic system as well as general information about the system.

- University of South Alabama

  http://www.usouthal.edu/biology/shardo/bly152/lymphatic.html

  This site offers general information on the lymphatic system, resistance, and immunity.

- McGraw-Hill

  http://www.mhhe.com/biosci/ap/vdgconcepts/student/olc/chapterindex23.htm

  Although geared to a text, this site provides information and exercises that are useful in supporting the material in this module.

- John Ross

  http://www.jdaross.mcmail.com/lymphatic_system.htm

  A privately maintained page, this site gives good general information on the lymphatic system from a lecturer of Luton University (UK).

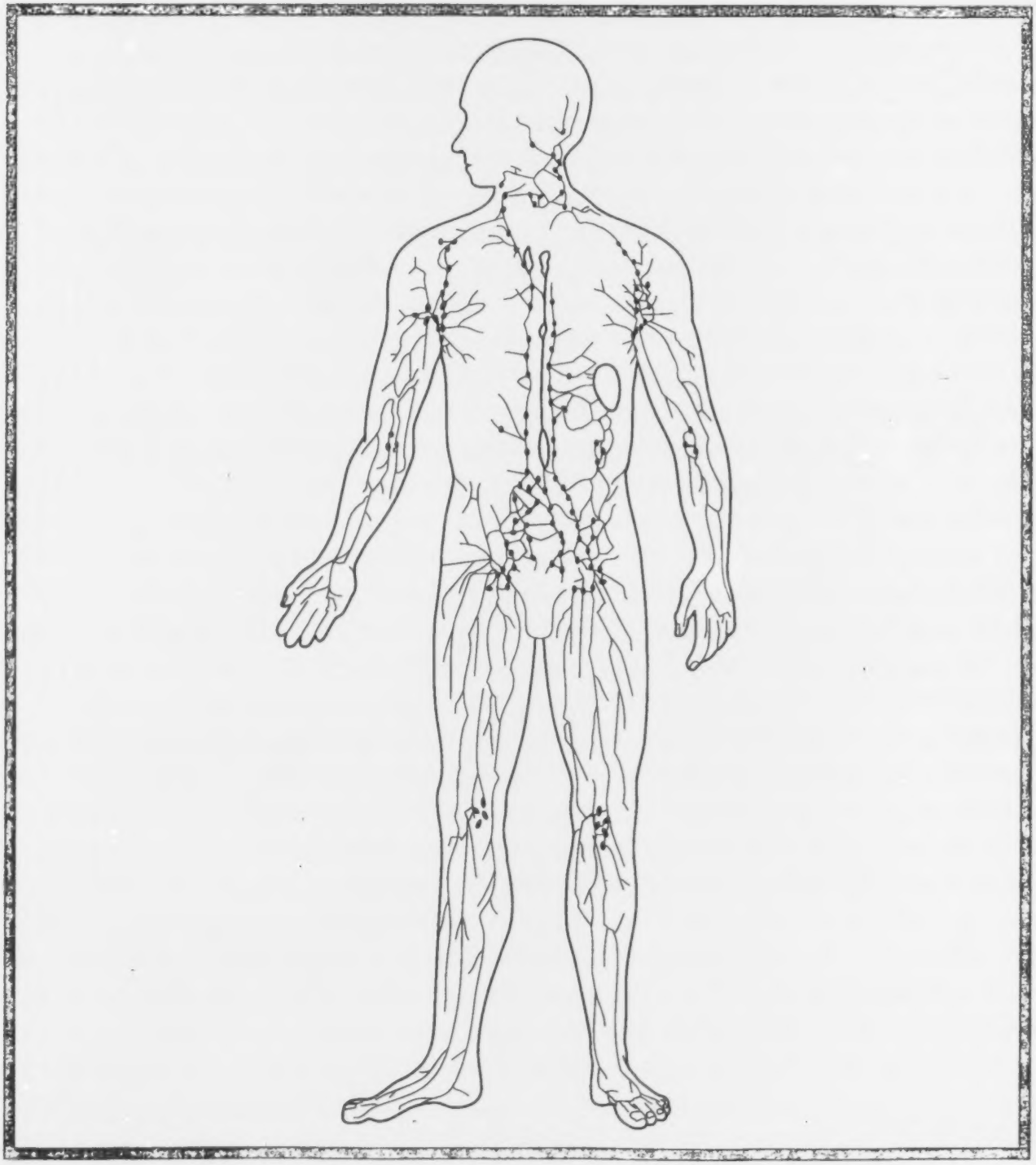
- Bartleby's

  http://www.bartleby.com/107/175.html

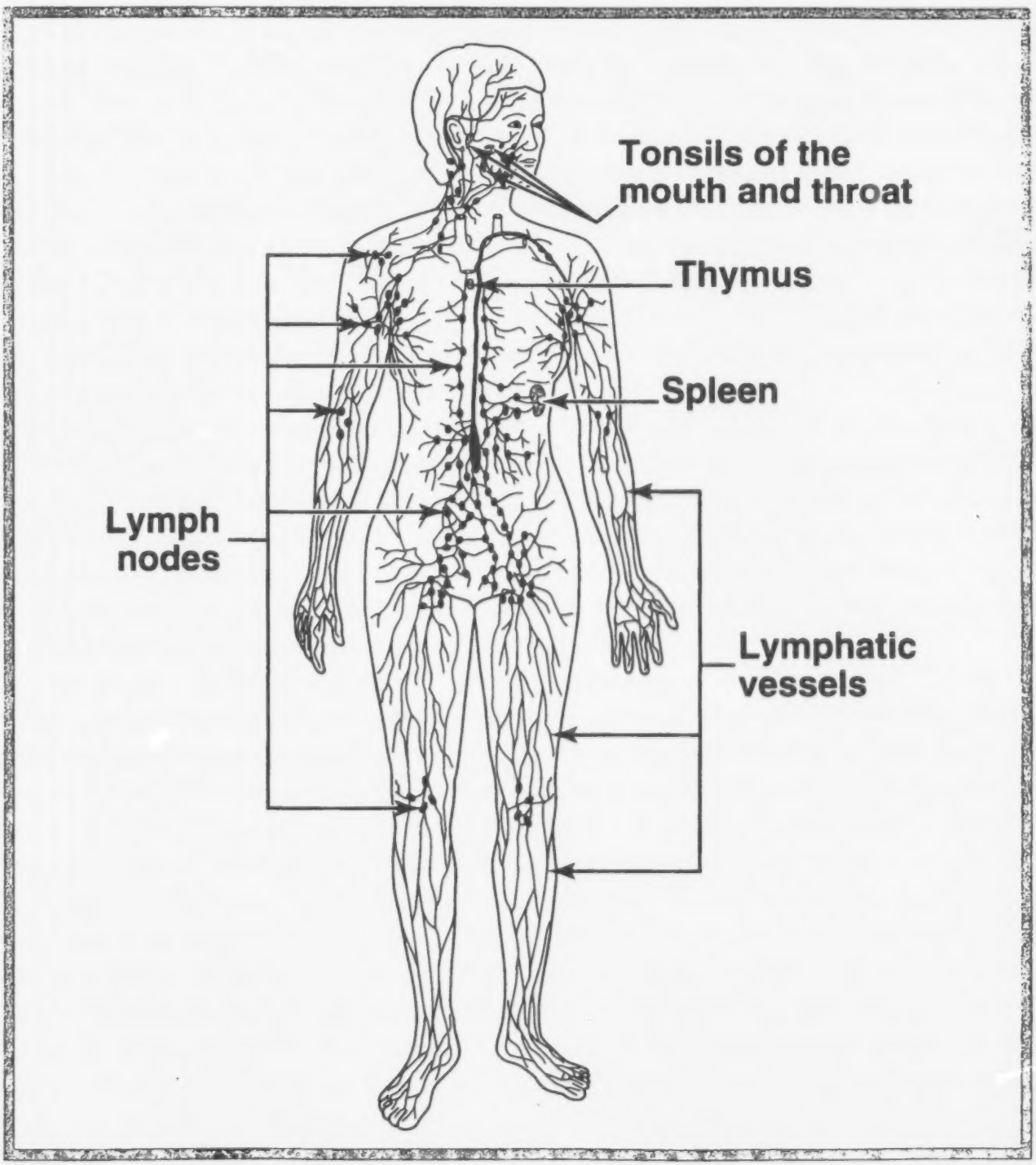
  Detailed anatomical descriptions and illustrations of the lymphatic system are featured on this site, which is modeled on *Gray's Anatomy*.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

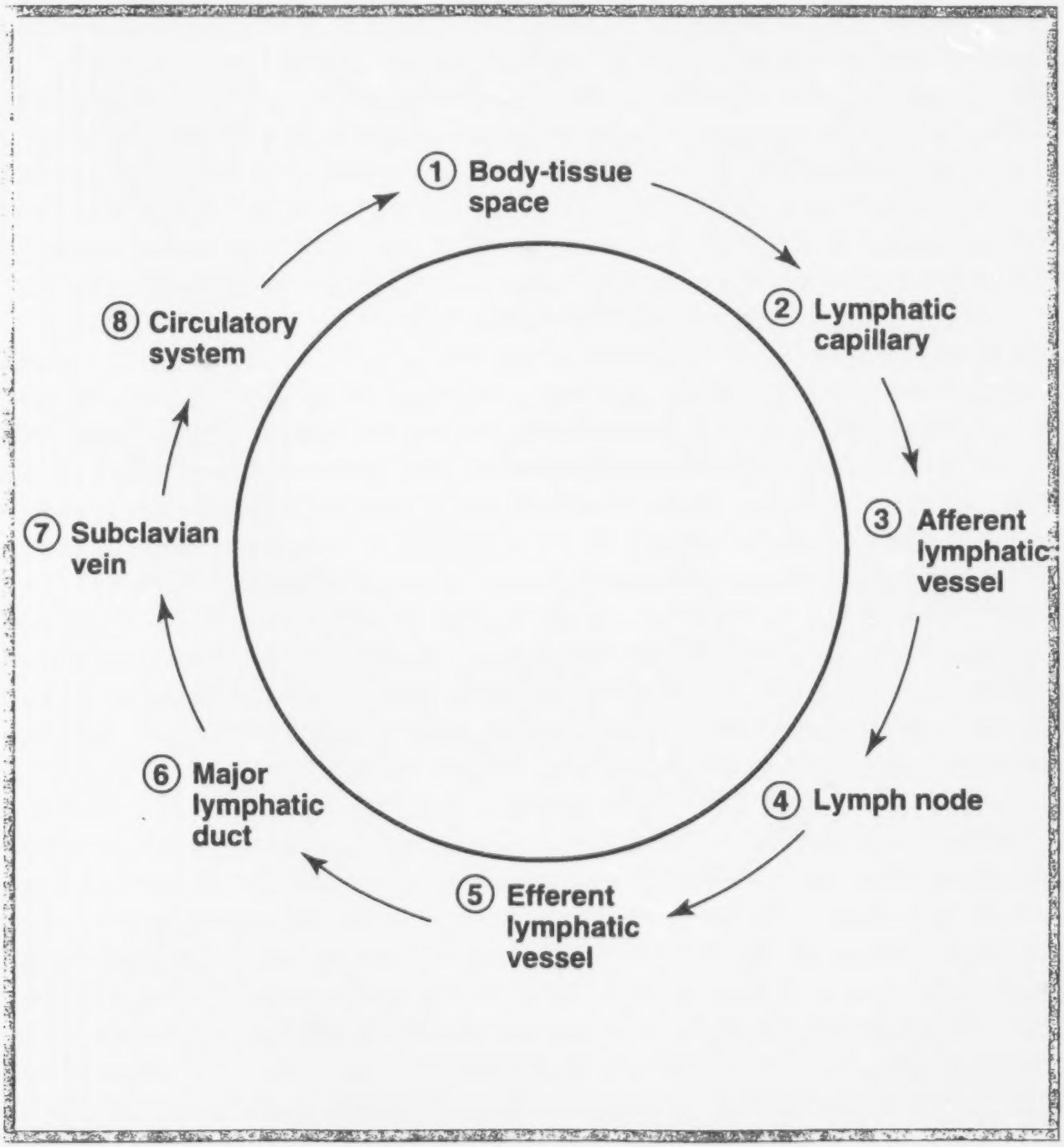
Lymphatic System



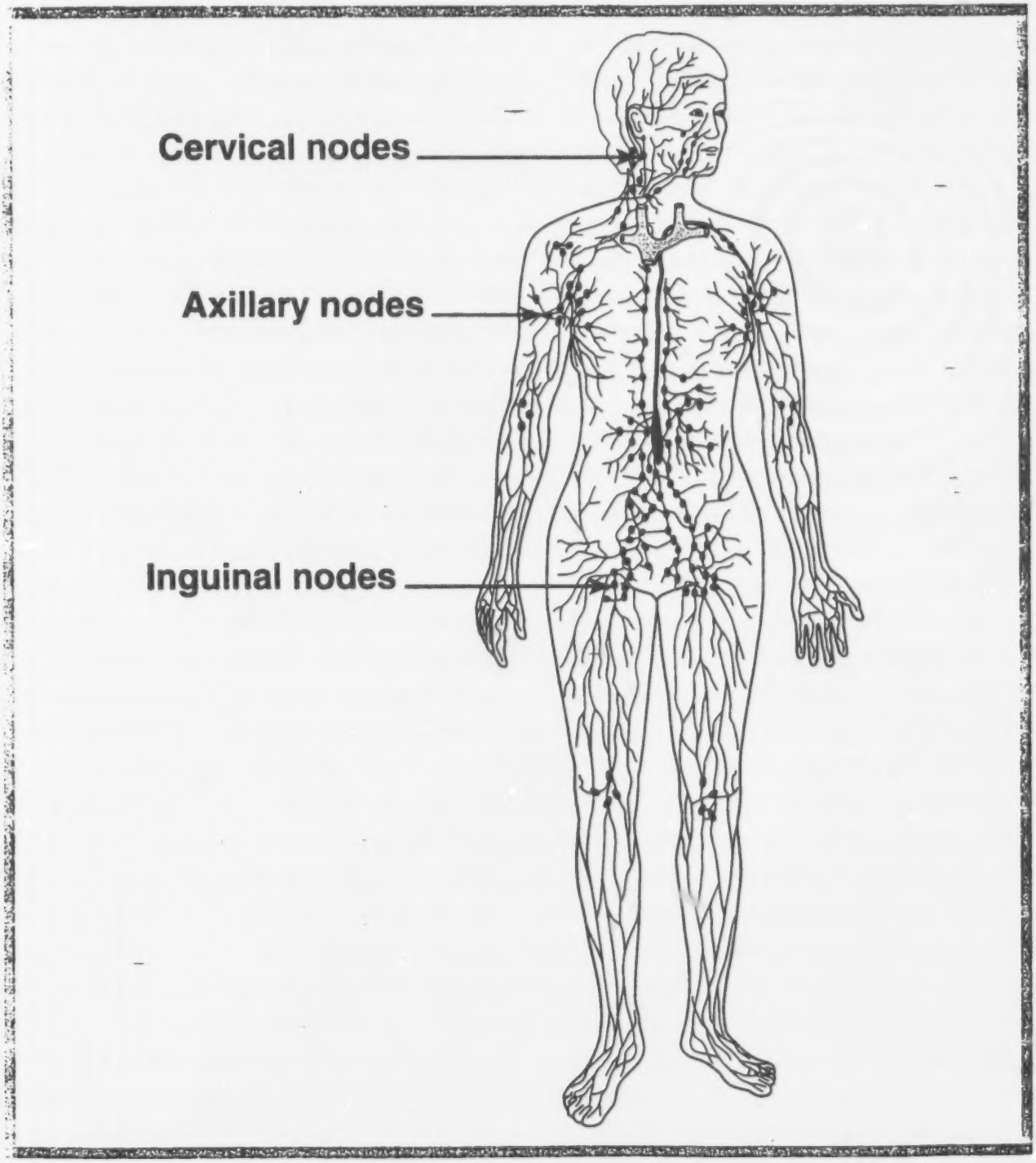
Major Structures of the Lymphatic System



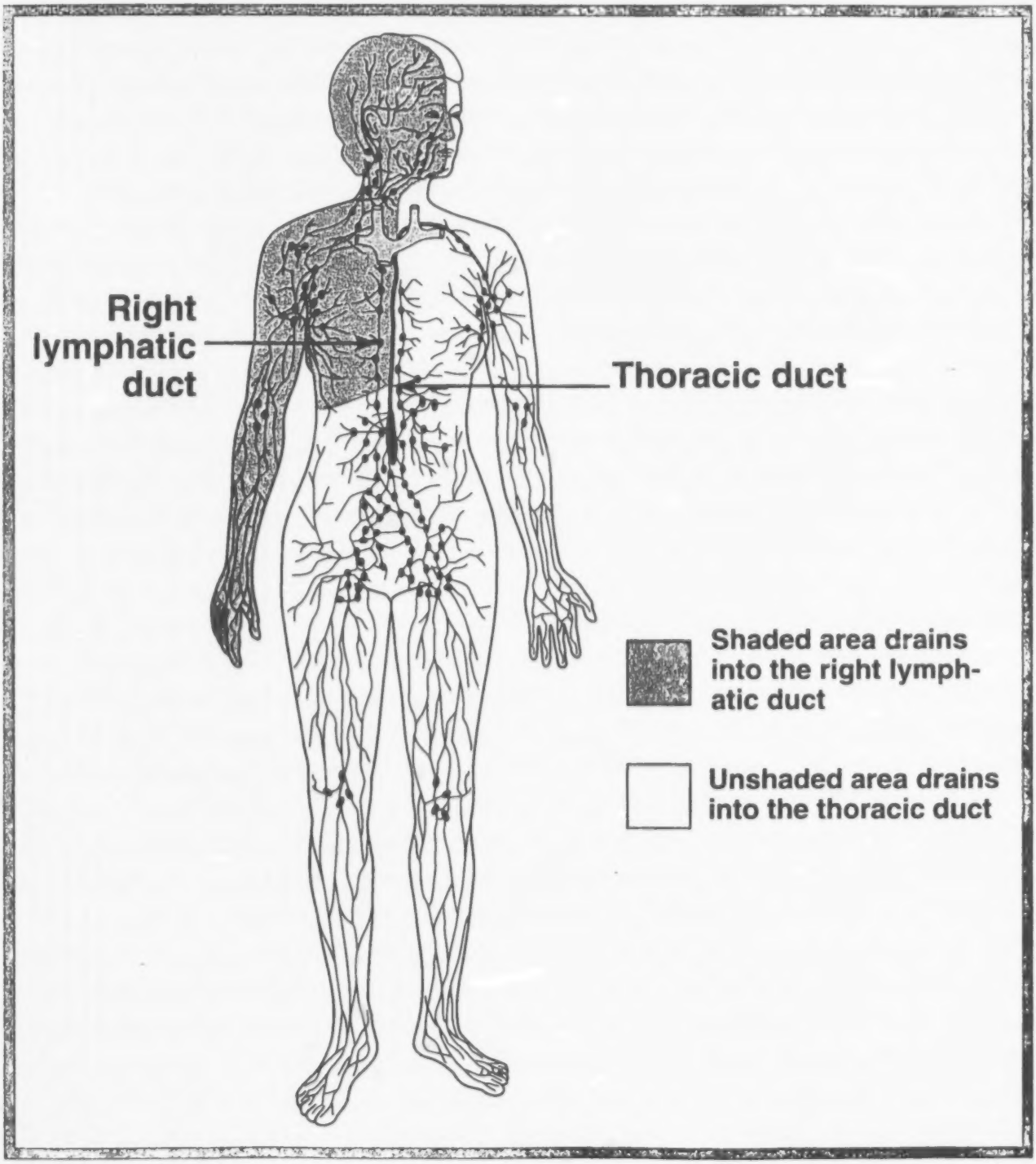
Sequence of Lymph Circulation Through the Lymphatic System



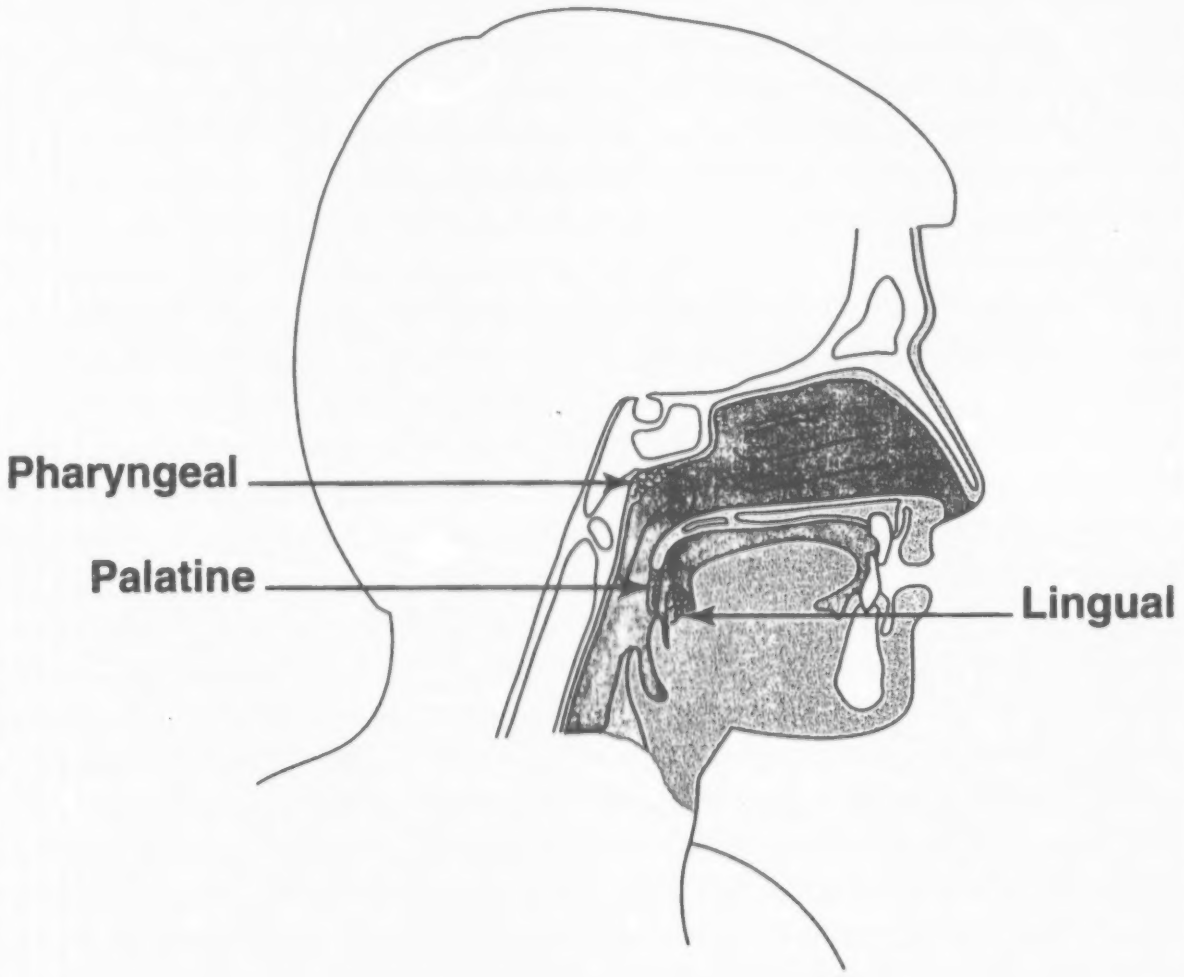
Major Groups of Lymph Nodes



Area of Drainage of the Major Lymphatic Ducts


Right lymphatic duct
Thoracic duct
Shaded area drains into the right lymphatic duct
Unshaded area drains into the thoracic duct

The Tonsils of the Mouth and Throat



Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *lymphatic system*. Write your answer on the blank lines provided beside the term below.

Lymphatic system _____

_____

_____

_____

_____

_____

_____

_____

Objective 2 List the major structures of the lymphatic system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

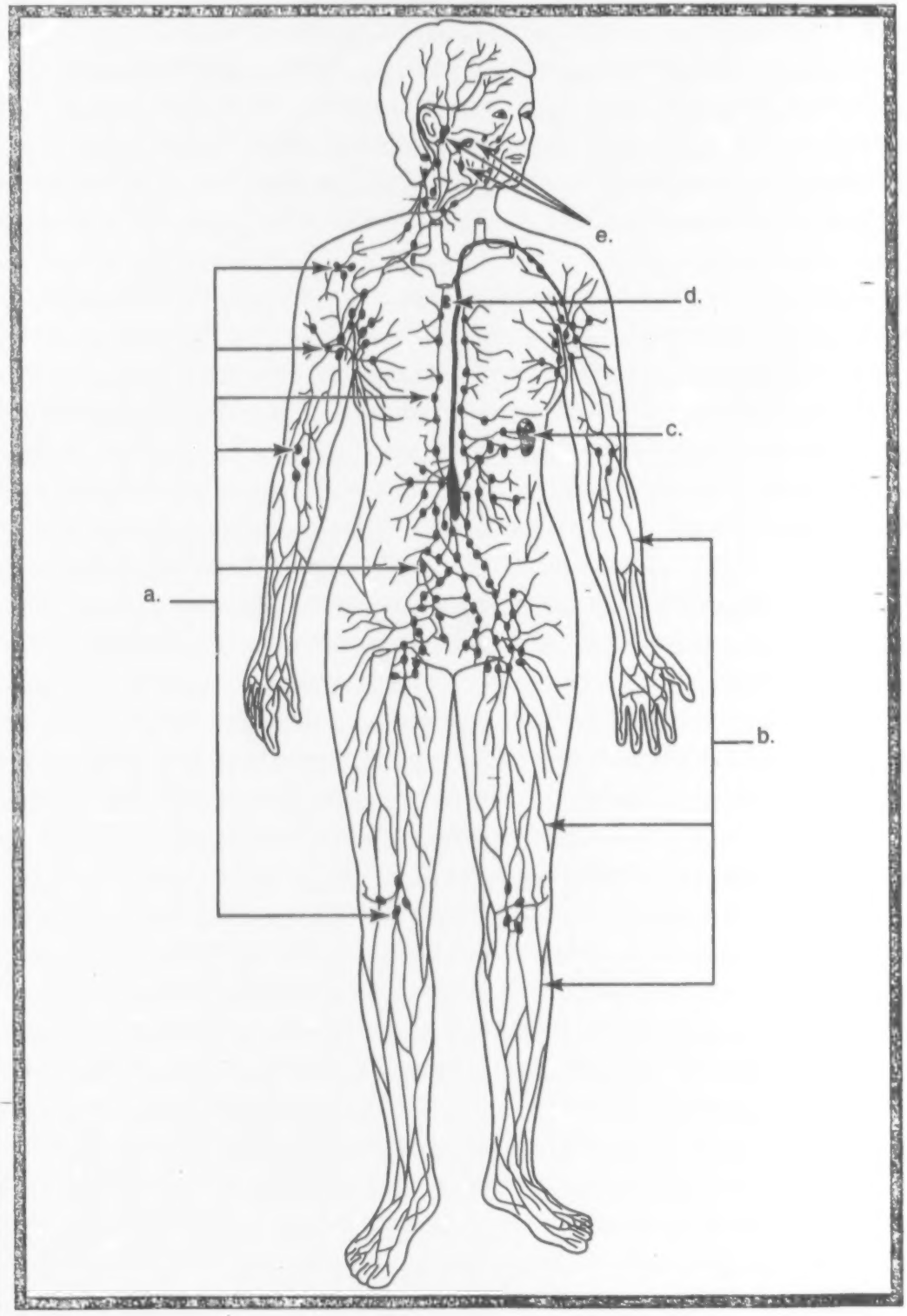
e. _____

f. _____

g. _____

OBJECTIVE 3

Label the major structures of the lymphatic system. Write your answers on the blank lines provided on the next page.

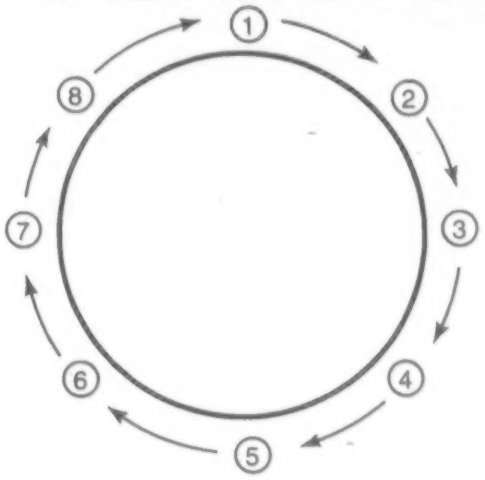


a. _____ d. _____

b. _____ e. _____

c. _____

Objective 4 State the sequence of lymph circulation through the major structures of the lymphatic system. Write your answers on the blank lines provided in the illustration below.



1. _____ 5. _____

2. _____ 6. _____

3. _____ 7. _____

4. _____ 8. _____

Objective 5 Complete statements that describe the characteristics of lymph and its movement through the body. Write your answers on the blank lines provided in the statements below and on the next page.

a. Lymph is a dynamic fluid that varies in appearance and composition depending on the _____, the _____, _____, and many other factors.

b. Lymph is a clear, colorless fluid though it may become milky where the lymph vessels drain into the intestines, due to the accumulation of _____.

c. Lymph differs from blood in that the _____ are absent.

d. Lymph resembles plasma in composition but contains less _____.

e. The lymphatic system has no pump to force movement; movement of lymph is caused by _____ and by the _____ of the skeletal system.

f. Lymph moves slowly and in one direction because the lymphatic vessels contain _____ that prevent the lymph from backflowing.

Objective 6 Complete statements that describe the characteristics of lymphatic capillaries. Write your answers on the blank lines provided in the statements below.

a. Lymphatic capillaries are the smallest lymphatic vessels and carry lymph from the _____ to larger _____.

b. Unlike blood capillaries, lymphatic capillaries do not bridge two larger vessels since one end lies in a _____ and the other connects to a _____.

c. Like blood capillaries, lymphatic capillaries consist of one layer of flattened _____ cells.

Objective 7 Complete statements that describe the characteristics of lymphatic vessels. Write your answers on the blank lines provided in the statements below.

a. Lymphatic vessels are thin-walled, very permeable vessels that convey lymph from lymphatic _____ to lymph _____ and from lymph _____ to lymphatic _____.

b. Lymphatic vessels resemble veins in that they consist of three tissue layers and have _____ to prevent backflow and keep lymph moving in only one direction.

Objective 8 Complete statements that describe the characteristics of lymph nodes. Write your answers on the blank lines provided in the statements below and on the next page.

a. Lymph nodes are deep or superficial masses of _____ tissue found along the lymphatic system.

b. Specific lymph nodes are identified by their _____ in the body.

c. Lymph nodes may be _____ in length.

d. Lymph nodes produce _____ and _____.

e. Lymph nodes serve as filters to keep substances such as bacteria from entering the _____.

Objective 9 Define the major groups of lymph nodes. Write your answers on the blank lines provided beside each of the terms below.

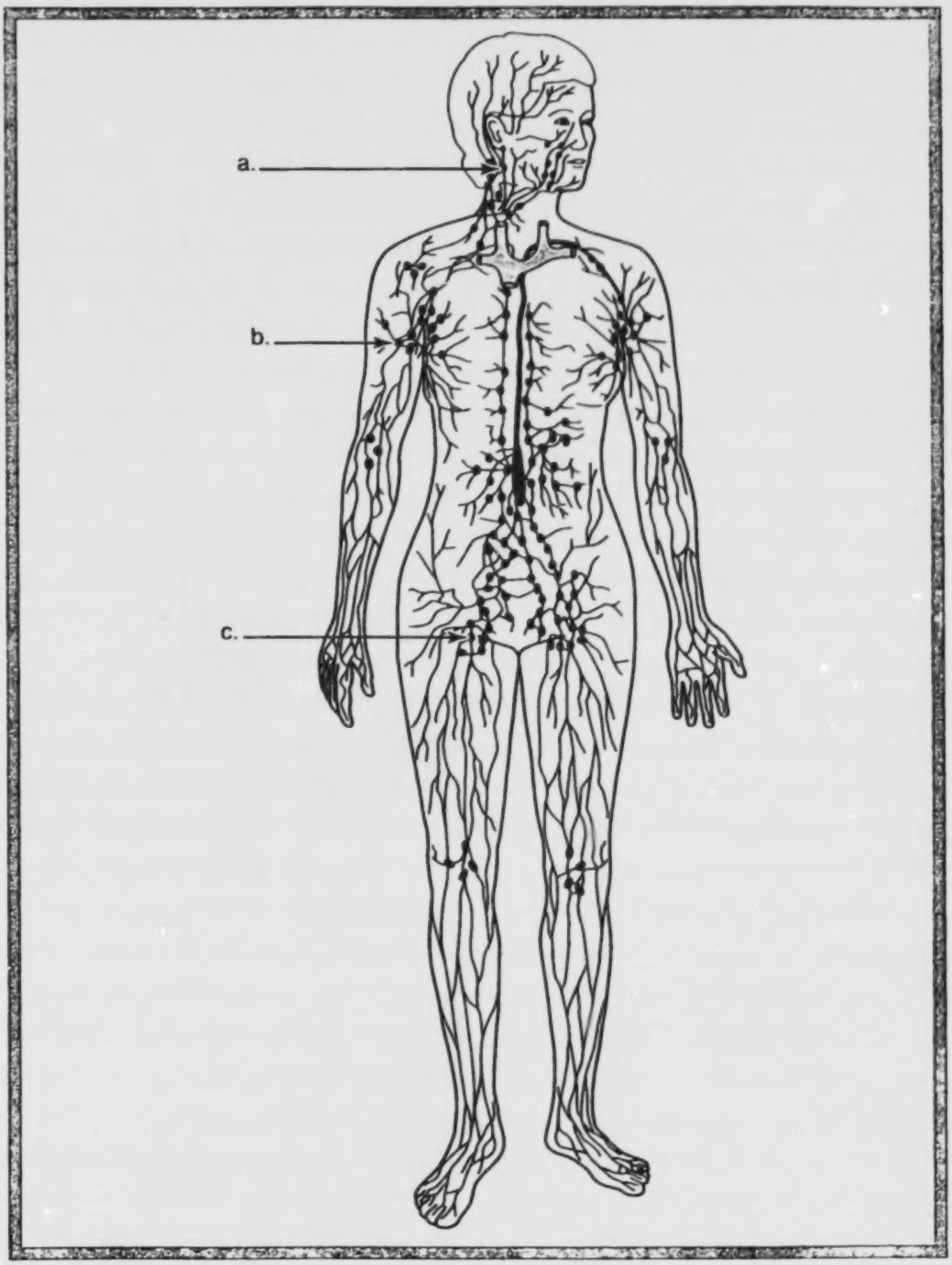
a. Cervical nodes _____

b. Axillary nodes _____

c. Inguinal nodes _____

OBJECTIVE 10

Label the major groups of lymph nodes. Write your answers on the blank lines provided below the following illustration.



a. _____ c. _____

b. _____

Objective 11 Define the major lymphatic ducts. Write your answers on the blank lines provided beside each of the terms below.

a. Right lymphatic duct _____

_____

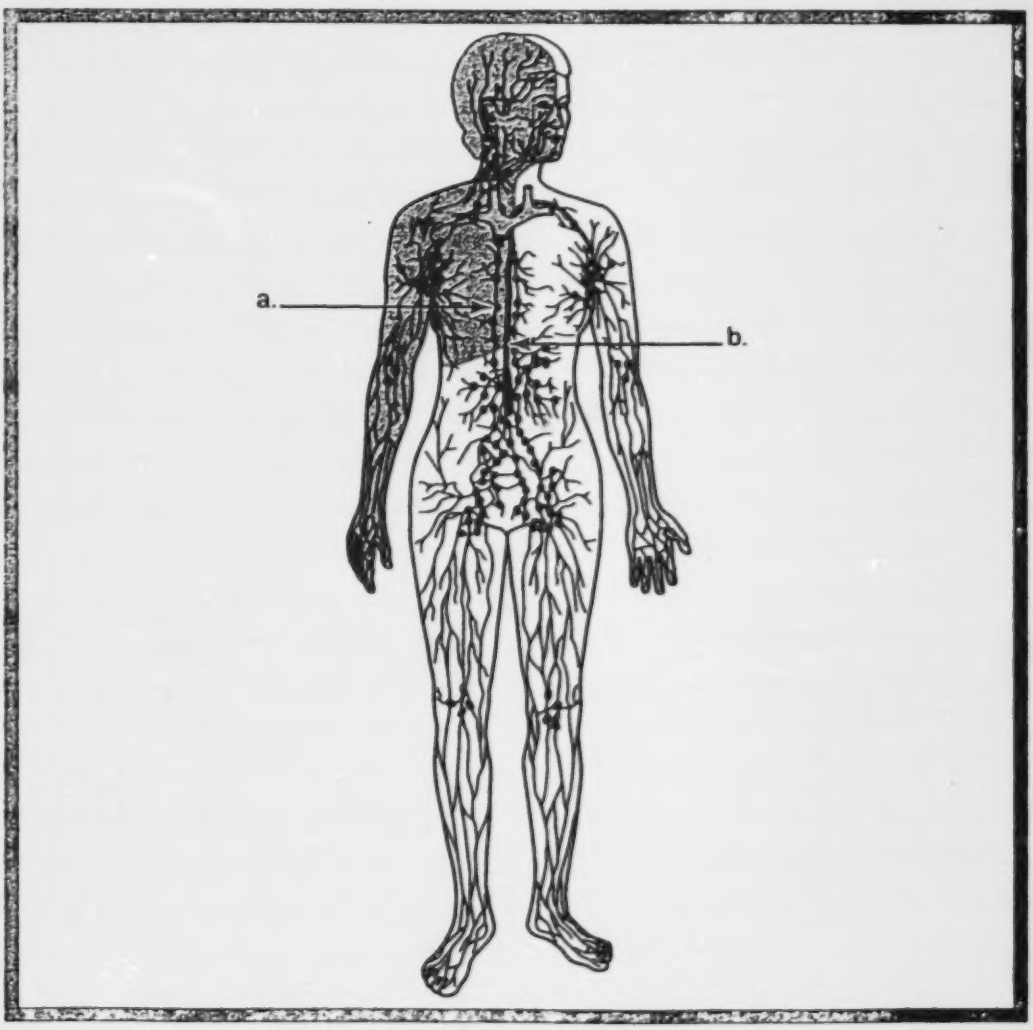
_____

b. Thoracic duct _____

_____

_____

Objective 12 Label the major lymphatic ducts. Write your answers on the blank lines provided below the following illustration.



a. _____ b. _____

Objective 13

Define the term *lymph nodule*. Write your answer on the blank lines provided beside the term below.

Lymph nodule _____

_____

_____

Objective 14

Complete statements that describe the characteristics of the spleen. Write your answers on the blank lines provided in the statements below.

a. The spleen is the largest mass of lymphoid tissue in the body; it is located in the upper left quadrant of the _____ behind the _____.

b. The spleen is 5 to 6 inches long and 2 to 3 inches wide and is soft, spongy, and _____ in color.

c. The spleen produces _____ in a fetus and _____ and _____ in adults.

d. The spleen filters _____ cells and other _____ matter and filters and destroys _____ and wornout _____ cells.

e. The spleen contains _____ cells that produce antibodies.

f. The spleen has an unusually large blood supply in relation to its size, and it stores about _____ cubic inches of blood that can be returned to the bloodstream in case of a hemorrhage or other emergency.

g. The spleen can be removed without severe adverse effects because other body parts such as the _____ and _____ can perform the spleen's functions.

Objective 15

Complete statements that describe the characteristics of the thymus. Write your answers on the blank lines provided in the statements below and on the next page.

a. The thymus is a _____-lobed organ located in the upper part of the _____ cavity along the _____ inferior to the _____ and posterior to the _____.

b. The thymus is the largest and most active during _____ and _____, but it decreases in size and activity after _____ and is replaced by connective tissue.

c. The thymus produces _____, which function in the body's defenses against infection, especially during prenatal life and infancy, and secretes _____, which is necessary for the maturity of T cells and for the growth of lymphoid tissue throughout the body.

OBJECTIVE 16

Complete statements that describe the characteristics of the tonsils. Write your answers on the blank lines provided in the statements below.

a. Tonsils are small, rounded masses of _____ tissue.

b. There are four major groups of tonsils: the _____ tonsils, the _____ tonsils, the _____ tonsils, and the _____ tonsils.

c. The _____, _____, and _____ tonsils are located in the back of the mouth and in the throat.

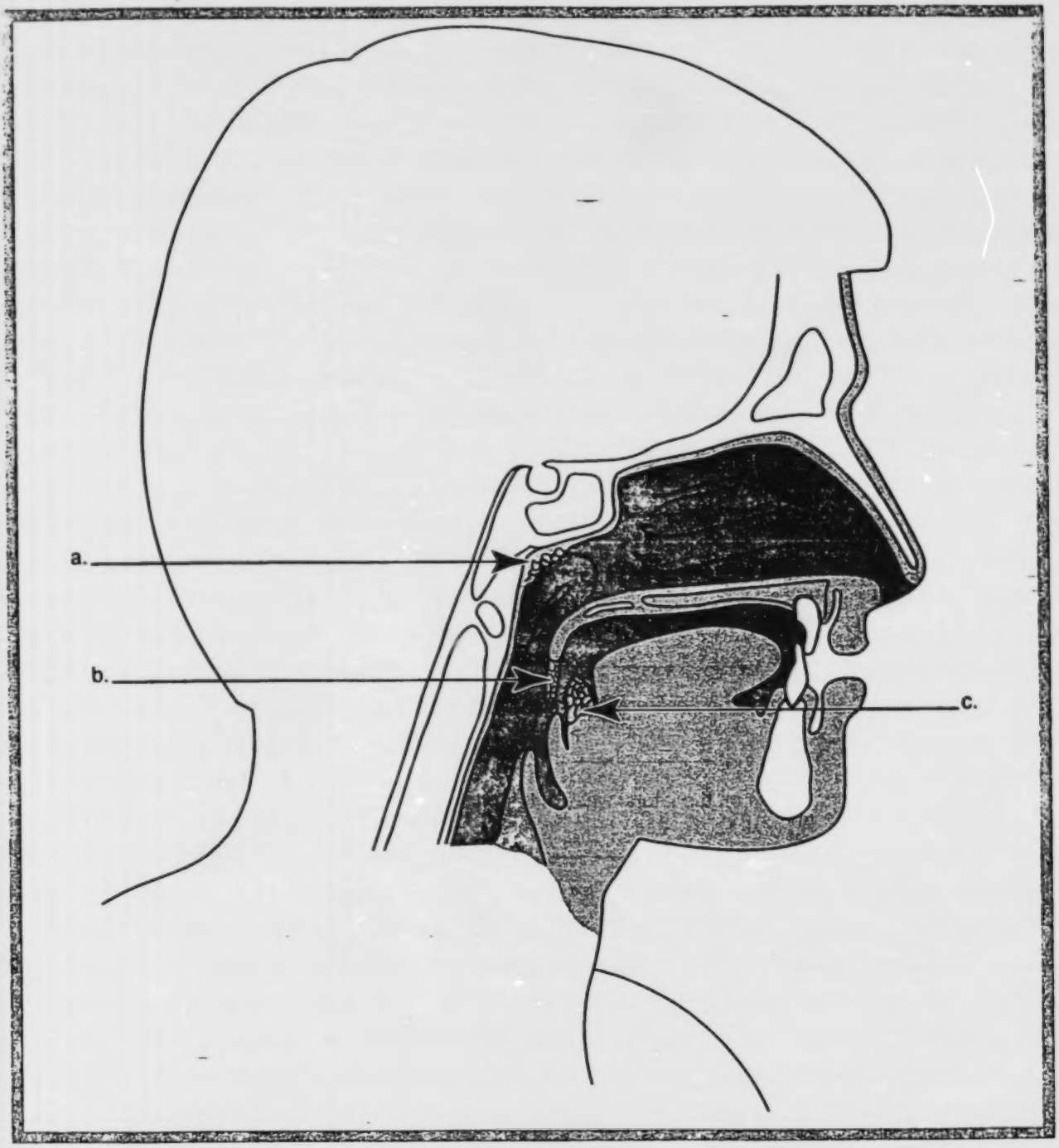
d. The _____ tonsils are a pair of almond-shaped masses each located behind the nose and on the roof of the posterior wall of the pharynx.

e. The _____ tonsils are a pair of tonsils each located in the back of the mouth on the lateral walls of the pharynx.

f. The _____ tonsil is a mass of lymph tissue near the root of the tongue.

g. The _____ tonsils are a group of lymphatic nodules forming a single layer in the mucous membrane of the ileum.

OBJECTIVE 17 | Label the tonsils of the mouth and throat. Write your answers on the blank lines provided below the following illustration.



a. _____ c. _____

b. _____

OBJECTIVE 18

Define common disorders and abnormalities of the lymphatic system. Write your answers on the blank lines provided beside each of the terms below.

a. Splenomegaly _____

_____

b. Lymphedema _____

_____

c. Lymphangitis _____

_____

d. Lymphoma _____

_____

e. Tonsillitis _____

_____

Answers to Written Test

OBJECTIVE 1

The vast, complex network of capillaries, thin vessels, valves, ducts, nodes, and organs that helps to protect and maintain the internal fluid environment of the entire body by producing, filtering, and conveying lymph and by producing various blood cells

OBJECTIVE 2

Answers may appear in any order.

a. Lymphatic capillaries
b. Lymphatic vessels
c. Lymph nodes
d. Major lymphatic ducts
e. Spleen
f. Thymus
g. Tonsils

OBJECTIVE 3

a. Lymph nodes
b. Lymphatic vessels
c. Spleen
d. Thymus
e. Tonsils

OBJECTIVE 4

Answers **must** appear in this order.

1. Body-tissue space
2. Lymphatic capillary
3. Afferent lymphatic vessel
4. Lymph node
5. Efferent lymphatic vessel
6. Major lymphatic duct
7. Subclavian vein
8. Circulatory system

OBJECTIVE 5

a. location in the body; health of the individual; diet
b. fat
c. red blood cells
d. protein
e. breathing; contractions
f. one-way valves

OBJECTIVE 6

a. tissue spaces; lymphatic vessels
b. pool of tissue fluid; larger lymphatic vessel
c. epithelial

Module 10: Lymphatic System

Objective 7

a. capillaries; nodes; nodes; ducts
b. valves

Objective 8

a. lymphoid
b. location
c. an inch (2.5 centimeters)
d. lymphocytes; monocytes
e. bloodstream

Objective 9

a. The major group of lymph nodes located on each side of the neck; the nodes on the right side of the head and neck drain into the right lymphatic duct, and the nodes on the left side of the head and neck drain into the thoracic duct

b. The major group of lymph nodes located in the left and right armpits; the nodes in the right thorax and arm drain into the right lymphatic duct, and the nodes in the left thorax and arm drain into the thoracic duct

c. The major group of lymph nodes located in the region of the groin; the nodes drain the lower extremities and external genital organs into the thoracic duct

Objective 10

a. Cervical nodes
b. Axillary nodes
c. Inguinal nodes

Objective 11

a. The major lymphatic vessel that conveys lymph from the right upper quadrant—head, neck, thorax, and upper extremity—of the body into the right subclavian vein

b. The common trunk of all the lymphatic vessels in the body, except those on the right upper quadrant of the body; it begins in the abdomen, travels through the thorax, ascends into the neck, over the clavicle, and into the left subclavian vein

Objective 12

a. Right lymphatic duct
b. Thoracic duct

Objective 13

Any of the tiny, densely packed spherical nodes or aggregates of lymph cells embedded mainly in the tonsils, spleen, and thymus

Objective 14

a. abdominal cavity; stomach
b. purplish
c. erythrocytes; lymphocytes; monocytes
d. cancer; particulate; bacteria; red blood
e. plasma
f. 11⅑₀
g. liver; bone marrow

Objective 15

a. two; chest; trachea; thyroid; sternum
b. prenatal life; infancy; puberty
c. lymphocytes (T cells); thymosin

Objective 16

a. lymphoid
b. pharyngeal; palatine; lingual; intestinal
c. pharyngeal; palatine; lingual
d. pharyngeal
e. palatine
f. lingual
g. intestinal

Objective 17

a. Pharyngeal
b. Palatine
c. Lingual

Objective 18

a. An enlargement of the spleen that is associated with various conditions including infections and hypertension

b. A disorder characterized by swelling and by the accumulation of lymph in soft tissue and caused by inflammation, obstruction, or removal of lymph channels

c. An inflammation of one or more lymphatic vessels due to infection of one of the extremities

d. A tumor involving lymphatic tissue

e. An infection of a tonsil

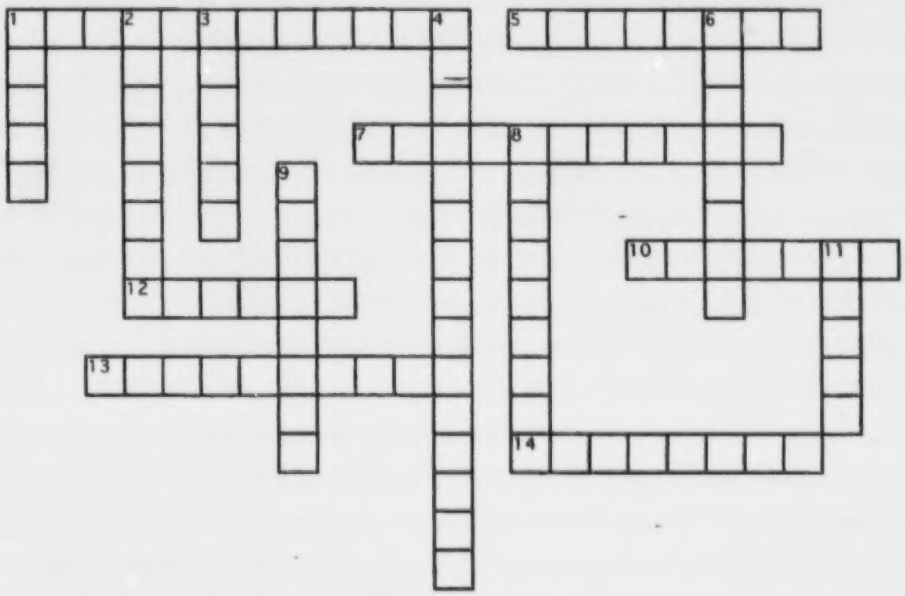
Answers to Assignment Sheet

Assignment Sheet 1

Answers must be evaluated to the satisfaction of the instructor, depending on the type of cancer assigned.

Crossword Puzzle 1—Terms from Objectives 1 Through 9

Name _____ Date _____



ACROSS

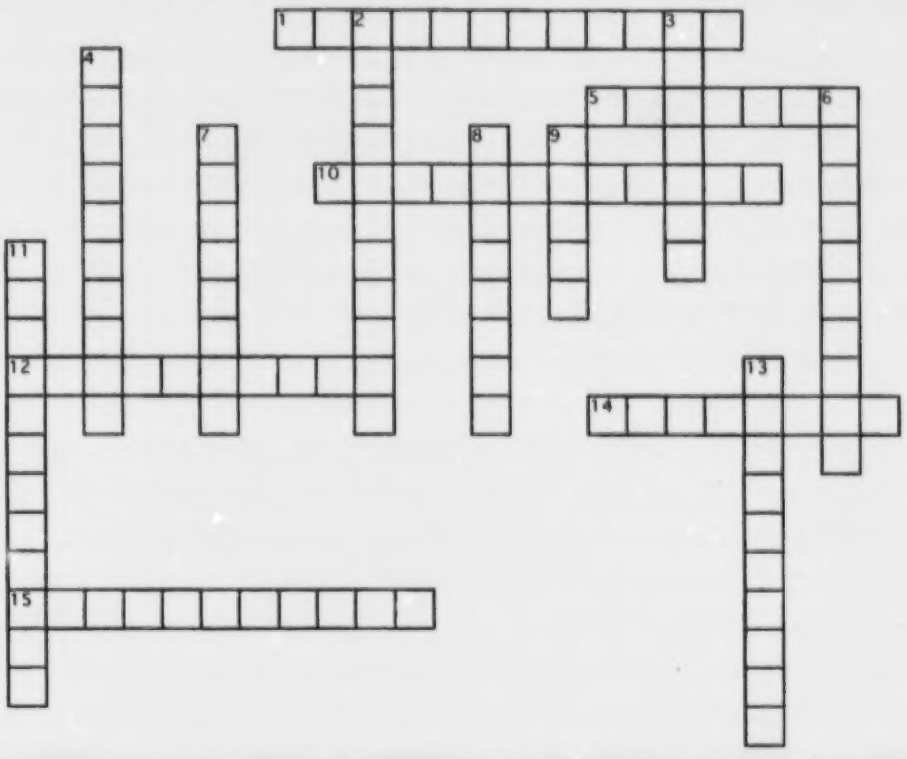
1. Situated within but not restricted to or characteristic of a particular organ or tissue
5. The _____ nodes are the major group of lymph nodes located in the left and right armpits; the nodes in the right thorax and arm drain into the right lymphatic duct, and the nodes in the left thorax and arm drain into the thoracic duct
7. The numerous, small lymphatic vessels that form networks throughout the tissue spaces in the body are called *lymphatic* _____
10. The masses of lymphoid tissue that are located in the back of the mouth, in the throat, and in the mucous membrane of the ileum
12. The glandular structure of largely lymphoid tissue that is located in the upper chest or at the base of the neck and functions especially in the development of the body's immune system
13. Small, oval structures that filter lymph, fight infection, and form lymphocytes, monocytes, and plasma cells (2 words)
14. The _____ nodes are the major group of lymph nodes located on each side of the neck; the nodes on the right side of the head and neck drain into the right lymphatic duct, and the nodes on the left side of the head and neck drain into the thoracic duct

DOWN

1. The last division of the small intestine
2. Conducting outward from a part
3. A soft, highly vascular organ located between the stomach and the diaphragm; it produces leukocytes, monocytes, lymphocytes, and plasma cells; stores blood cells; and filters out bacteria and wornout red blood cells
4. The vast, complex network of capillaries, thin vessels, valves, ducts, nodes, and organs that helps to protect and maintain the internal fluid environment of the entire body by producing, filtering, and conveying lymph and by producing various blood cells (2 words)
6. Bearing or conducting inward
8. _____ vessels are fine, transparent, valved channels that carry lymph and tissue fluid, are distributed through most tissues, and are characterized by a beaded appearance; also called *lymph vessels*
9. The _____ nodes are the major group of lymph nodes located in the region of the groin; the nodes drain the lower extremities and external genital organs into the thoracic duct
11. A dynamic fluid that varies in appearance and composition depending on the location in the body, the health of the individual, diet, and many other factors

Crossword Puzzle 2—Terms from Objectives 11 Through 18

Name _____ Date _____



ACROSS

1. An enlargement of the spleen that is associated with various conditions including infections and hypertension
5. The _____ tonsil is a mass of lymph tissue near the root of the tongue
10. The common trunk of all the lymphatic vessels in the body, except those on the right upper quadrant of the body; it begins in the abdomen, travels through the thorax, ascends into the neck, over the clavicle, and into the left subclavian vein (2 words)
12. The _____ tonsils are a pair of almond-shaped masses each located behind the nose and on the roof of the posterior wall of the pharynx; commonly called the *adenoids*
14. A tumor involving lymphatic tissue
15. An infection of a tonsil

DOWN

2. Any of the tiny, densely packed spherical nodes or aggregates of lymph cells embedded mainly in the tonsils, spleen, and thymus (2 words)
3. Pertaining to the tongue
4. The _____ tonsils are a group of lymphatic nodules forming a single layer in the mucous membrane of the ileum; also called *Peyer's patches*
6. A disorder characterized by swelling and by the accumulation of lymph in soft tissue and caused by inflammation, obstruction, or removal of lymph channels
7. The _____ tonsils are a pair of tonsils each located in the back of the mouth on the lateral walls of the pharynx; commonly called *the tonsils*
8. Pertaining to the palate, the structure that forms the roof of the mouth
9. The _____ lymphatic duct is the major lymphatic vessel that conveys lymph from the right upper quadrant—head, neck, thorax, and upper extremity—of the body into the right subclavian vein
11. An inflammation of one or more lymphatic vessels due to infection of one of the extremities
13. Pertaining to the pharynx (the throat)

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS

1. INTERSTITIAL
5. AXILLARY
7. CAPILLARIES
10. TONSILS
12. THYMUS
13. LYMPH NODES
14. CERVICAL

DOWN

1. ILEUM
2. EFFERENT
3. SPLEEN
4. LYMPHATIC SYSTEM
6. AFFERENT
8. LYMPHATIC
9. INGUINAL
11. LYMPH

Crossword Puzzle 2

ACROSS

1. SPLENOMEGALY
5. LINGUAL
10. THORACIC DUCT
12. PHARYNGEAL
14. LYMPHOMA
15. TONSILLITIS

DOWN

2. LYMPH NODULE
3. LINGUAL
4. INTESTINAL
6. LYMPHEDEMA
7. PALATINE
8. PALATINE
9. RIGHT
11. LYMPHANGITIS
13. PHARYNGEAL

Module Review

Name _____

Date _____ Score _____

Directions Read each item. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 18

1. _____ is an inflammation of one or more lymphatic vessels due to infection of one of the extremities.

   a. Splenomegaly
   b. Lymphedema
   c. Lymphangitis
   d. Splenangitis

Objective 15

2. The thymus is largest and most active during _____.

   a. viral infections
   b. prenatal life and infancy
   c. pregnancy
   d. exercise

Objective 6

3. Lymphatic capillary walls consist of _____.

   a. one layer of flattened epithelial cells
   b. two layers of flattened epithelial cells
   c. one layer of connective tissue
   d. two layers of connective tissue

Objective 1

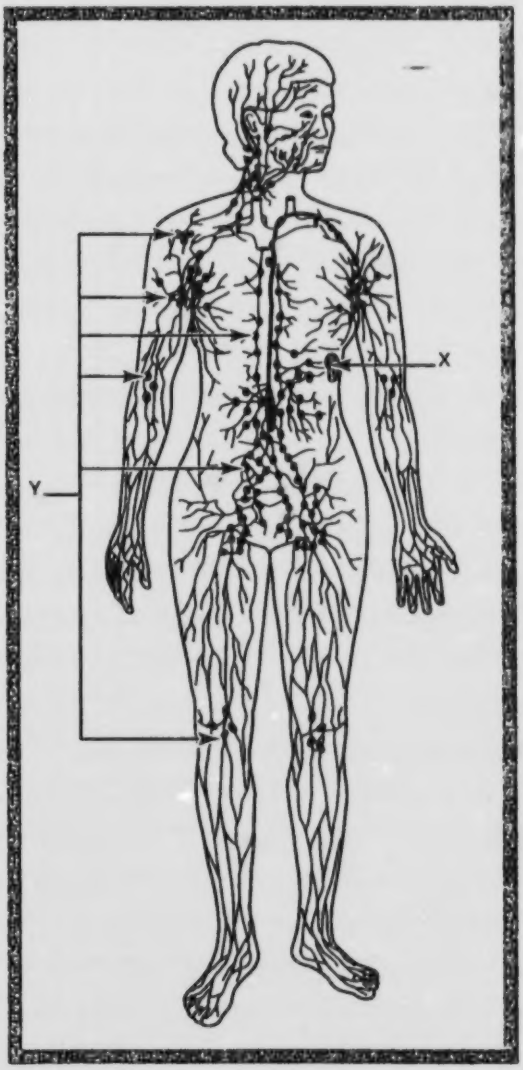
4. What is the function of the lymphatic system?

   a. maintenance of the internal fluid environment of the body
   b. filtering lymph
   c. both "a" and "b"
   d. neither "a" nor "b"

Objective 3

5. The structure indicated by the letter "X" in the illustration below is the _____.

   a. thymus
   b. spleen
   c. liver
   d. tonsils



Objective 3

6. The structures indicated by the letter "Y" in the illustration above are the _____.

   a. blood vessels
   b. lymphatic vessels
   c. lymph nodes
   d. lymph nodules

Objective 4

7. The flow of lymph from the body-tissue space to the circulatory system has the following intervening steps: _____.

   a. lymphatic capillary, afferent lymphatic vessel, lymph node, efferent lymphatic vessel, major lymphatic duct, subclavian vein

   b. lymphatic capillary, efferent lymphatic vessel, major lymphatic duct, afferent lymphatic vessel, lymph node, subclavian vein

   c. afferent lymphatic vessel, lymphatic capillary, lymph node, efferent lymphatic vessel, major lymphatic duct, subclavian vein

   d. afferent lymphatic vessel, lymphatic capillary, major lymphatic duct, efferent lymphatic vessel, lymph node, subclavian vein

Objective 6

8. Lymph capillaries are the _____ lymphatic vessels and carry lymph from _____.

   a. thickest; lymphatic arteries to lymphatic veins

   b. smallest; the tissue spaces to larger lymphatic vessels

   c. largest; the spleen to smaller lymphatic vessels

   d. first; the mother to the fetus

Objective 18

9. _____ is a disorder caused by inflammation, obstruction, or removal of lymph channels.

   a. Splenomegaly

   b. Lymphedema

   c. Lymphangitis

   d. Splenangitis

Objective 18

10. Tonsillitis is _____ of a tonsil.

   a. an infection

   b. surgical removal

   c. cancer

   d. a genetic defect

Objective 15

11. The thymus decreases in size and activity after _____ and is replaced by _____.

   a. release of T cells to fight infections; dormant B cells

   b. puberty; connective tissue

   c. delivery of one's baby; fatty tissue

   d. rest; muscle tissue

Objective 7

12. Lymphatic vessels _____.

    a. resemble arteries structurally

    b. have two tissue layers

    c. have valves to prevent backflow

    d. allow lymph to move in two directions

Objective 16

13. The _____ tonsils are commonly called *the adenoids*, while the ____ tonsils are commonly called *the tonsils*.

    a. palatine; lingual

    b. lingual; pharyngeal

    c. pharyngeal; palatine

    d. palatine; pharyngeal

Objective 8

14. Specific lymph nodes are identified by _____.

    a. their location in the body

    b. numbers

    c. the major artery into which they drain

    d. the blood vein into which they drain

Objective 18

15. A tumor involving lymphatic tissue is referred to as _____.

    a. *lymphenoma*

    b. *lymphedema*

    c. *lymphangitis*

    d. *lymphoma*

Objective 11

16. Which of the following is NOT a true statement about the right lymphatic duct?

    a. The right lymphatic duct empties into the right subclavian vein.

    b. The right lymphatic duct is located above the diaphragm.

    c. The right lymphatic duct is located on the right side of the body.

    d. The right lymphatic duct receives lymph from the right side of abdomen, pelvis, and lower extremities.

Objective 14

17. Which of the following statements is NOT a function of the spleen?

    a. It produces monocytes in the fetus.

    b. It produces lymphocytes in adults.

    c. It filters cancer cells and other particulate matter.

    d. It filters and destroys bacteria and wornout red blood cells.

Objective 9

18. The axillary lymph nodes are located in the _____ and _____.

    a. shoulder blades; the nodes in the back and right arm drain into the right lymphatic duct, and the nodes in the chest and left arm drain into the thoracic duct

    b. shoulder blades; the nodes in the chest and right arm drain into the right lymphatic duct, and the nodes in the back and left arm drain into the thoracic duct

    c. armpits; the nodes in the left thorax and arm drain into the right lymphatic duct, and the nodes in the right thorax and arm drain into the thoracic duct

    d. armpits; the nodes in the right thorax and arm drain into the right lymphatic duct, and the nodes in the left thorax and arm drain into the thoracic duct

Objective 13

19. Lymph nodules are located _____.

    a. along the major arteries

    b. along the major veins

    c. mainly in the tonsils, spleen, and thymus

    d. beneath all mucous membranes

Objective 9

20. The cervical lymph nodes are located _____ and _____.

    a. on each side of the neck; drain into the cervical vertebra

    b. on each side of the neck; the nodes of the right side of the head and neck drain into the right lymphatic duct, and the nodes on the left side of the head and neck drain into the thoracic duct

    c. in the cervical vertebra; the nodes on the left side of the head and neck drain into the right lymphatic duct, and the nodes on the right side of the head and neck drain into the thoracic duct

    d. in the cervical vertebra; the nodes on the right side of the head and neck drain into the right lymphatic duct, and the nodes on the left side of the head and neck drain into the thoracic duct

Objective 10

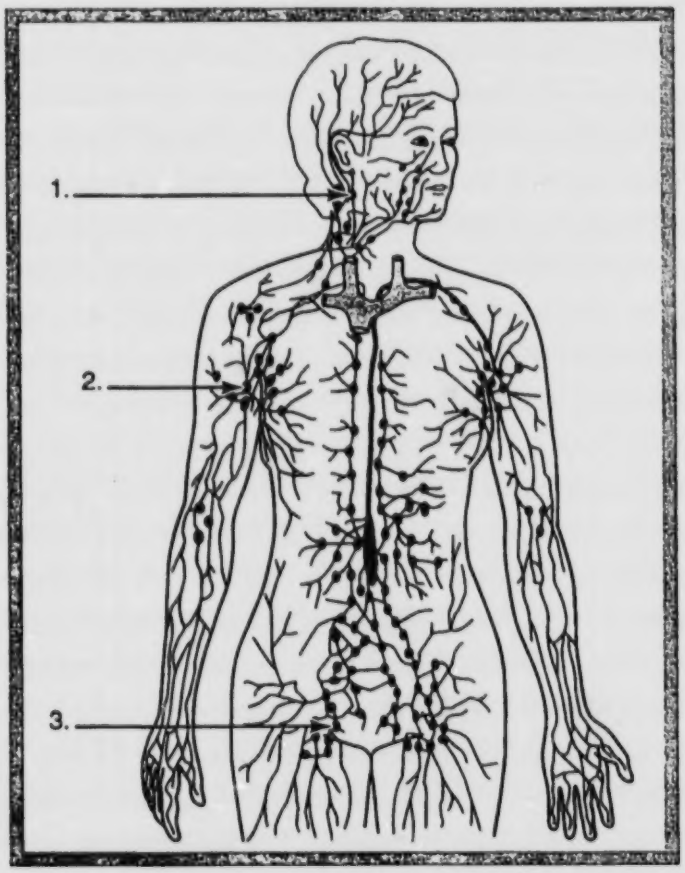
21. In the illustration below, which of the following is the correct labeling of the major lymph nodes?

    a. (1) cervical, (2) axillary, (3) inguinal

    b. (1) axillary, (2) inguinal, (3) cervical

    c. (1) inguinal, (2) cervical, (3) axillary

    d. (1) cervical, (2) inguinal, (3) axillary



Objective 8

22. Lymph nodes serve as filters to keep substances such as _____ from entering the bloodstream.

    a. monocytes

    b. bile

    c. lymph fluid

    d. bacteria

Objective 15

23. The thymus produces _____ that function in the body's defenses against infection, especially during _____.

    a. monocytes; adulthood

    b. monocytes; prenatal life and infancy

    c. lymphocytes; adulthood

    d. lymphocytes; prenatal life and infancy

Objective 12

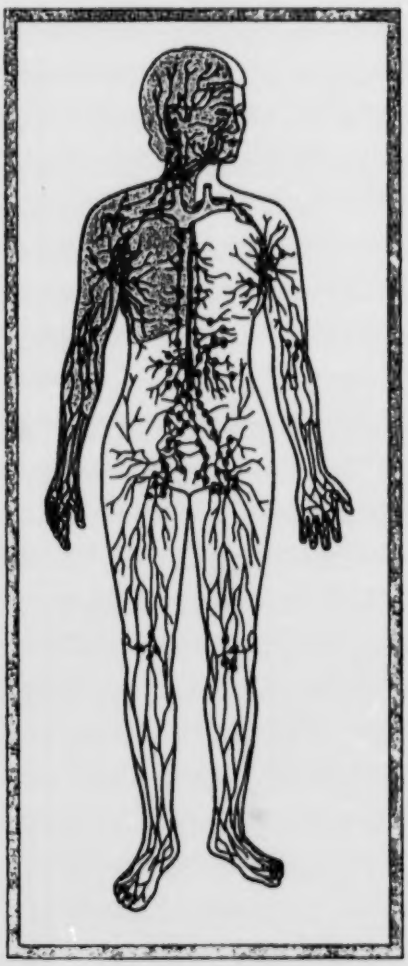
24. The blue-shaded area in the illustration below depicts drainage into the _____.

    a. thoracic duct

    b. right lymphatic duct

    c. left lymphatic duct

    d. axillary lymphatic duct



Objective 9

25. The inguinal lymph nodes are located in the _____ and the nodes drain the lower extremities into the _____.

    a. buttocks; thoracic duct

    b. buttocks; right lymphatic duct

    c. groin; thoracic duct

    d. groin; right lymphatic duct

Objective 13

26. Which of the following statements is a correct comparison between lymph nodes and lymph nodules?

    a. Lymph nodes are much larger than lymph nodules.

    b. Lymph nodules are much larger than lymph nodes.

    c. Lymph nodes and lymph nodules are both about the size of an egg.

    d. Lymph nodes and lymph nodules are both about the size of the head of a pin.

Objective 2

27. Which of the following is NOT considered a major structure of the lymphatic system?

    a. spleen

    b. liver

    c. thymus

    d. tonsils

Objective 15

28. The thymus is a _____ organ located in the upper part of the chest cavity along the trachea inferior to the _____ and posterior to the sternum.

    a. two-lobed; thyroid

    b. two-lobed; parathyroid

    c. cylindrical; thyroid

    d. cylindrical; parathyroid

Objective 11

29. The thoracic duct _____.

    a. begins in the posterior part of the abdominal cavity, extends upward through the diaphragm, along the posterior wall of the thorax, and into the base of the neck of the right side

    b. receives lymph from all parts of the body except those above the diaphragm on the right side

    c. empties into the right subclavian vein

    d. circulates lymph through the spleen

Objective 15

30. The thymus secretes _____, which is necessary for the maturity of _____ and for the growth of lymphoid tissue throughout the body.

    a. thymosin; T cells

    b. thymosin; monocytes

    c. lymph; T cells

    d. lymph; monocytes

Objective 14

31. Which of the following is a correct statement regarding the spleen?

    a. It contains plasma cells that produce antigens.

    b. It stores about 750 cubic centimeters of blood that can be returned to the bloodstream in case of a hemorrhage or other emergency.

    c. It can be removed without severe adverse effects because other body parts such as the liver and bone marrow can perform the spleen's functions.

    d. It becomes more active with increasing age.

Objective 18

32. _____ is an enlargement of the spleen that is associated with various conditions including infections and hypertension.

    a. Splenomegaly

    b. Lymphedema

    c. Lymphangitis

    d. Splenangitis

Objective 7

33. Which of the following is NOT true of lymphatic vessels?

    a. Lymphatic vessels are thin-walled, very permeable vessels.

    b. Lymphatic vessels are thick-walled, semipermeable vessels.

    c. Lymphatic vessels convey lymph from lymphatic capillaries to lymph nodes.

    d. Lymphatic vessels convey lymph from lymph nodes to lymphatic ducts.

Objective 8

34. Lymph nodes are _____ masses of lymphoid tissue found along the lymphatic system.

    a. hard

    b. egg-sized

    c. deep or superficial

    d. all of the above

Objective 5

35. Which of the following statements is NOT correct about the movement of lymph?

a. The lymphatic system has no pump to force movement.

b. Movement of lymph is caused by breathing and by the contractions of the skeletal muscles.

c. Lymph moves at about the same speed as blood.

d. Lymph moves in one direction because the vessels contain one-way valves that prevent the lymph from backflowing.

Objective 8

36. Lymph nodes produce _____.

a. leukocytes and lymph fluid

b. lymphocytes and monocytes

c. lymph fluid and interstitial fluid

d. monocytes and polycytes

Objective 6

37. One end of a lymphatic capillary _____ and the other connects to a _____.

a. attaches to the spleen; blood vessel

b. attaches to a lymphatic vein; lymphatic artery

c. connects to the lymph pump; smaller lymphatic vessel

d. lies in a pool of tissue fluid; larger lymphatic vessel

Objective 14

38. Which of the following is NOT a correct statement about the spleen?

a. The spleen is the largest mass of lymphoid tissue in the body.

b. The spleen is located in the upper left quadrant of the abdominal cavity behind the stomach.

c. The spleen is 5 to 6 inches wide and 2 to 3 inches long.

d. The spleen is soft, spongy, and purplish in color and has an unusually large blood supply in relation to its size.

Objective 5

39. Which of the following phrases is NOT a correct characteristic of lymph?

a. is a clear, colorless fluid

b. may become milky where the lymphatic vessels drain into the intestines, due to the accumulation of fat

c. differs from blood in that the red blood cells are absent

d. resembles plasma in composition but contains more protein

Objective 17

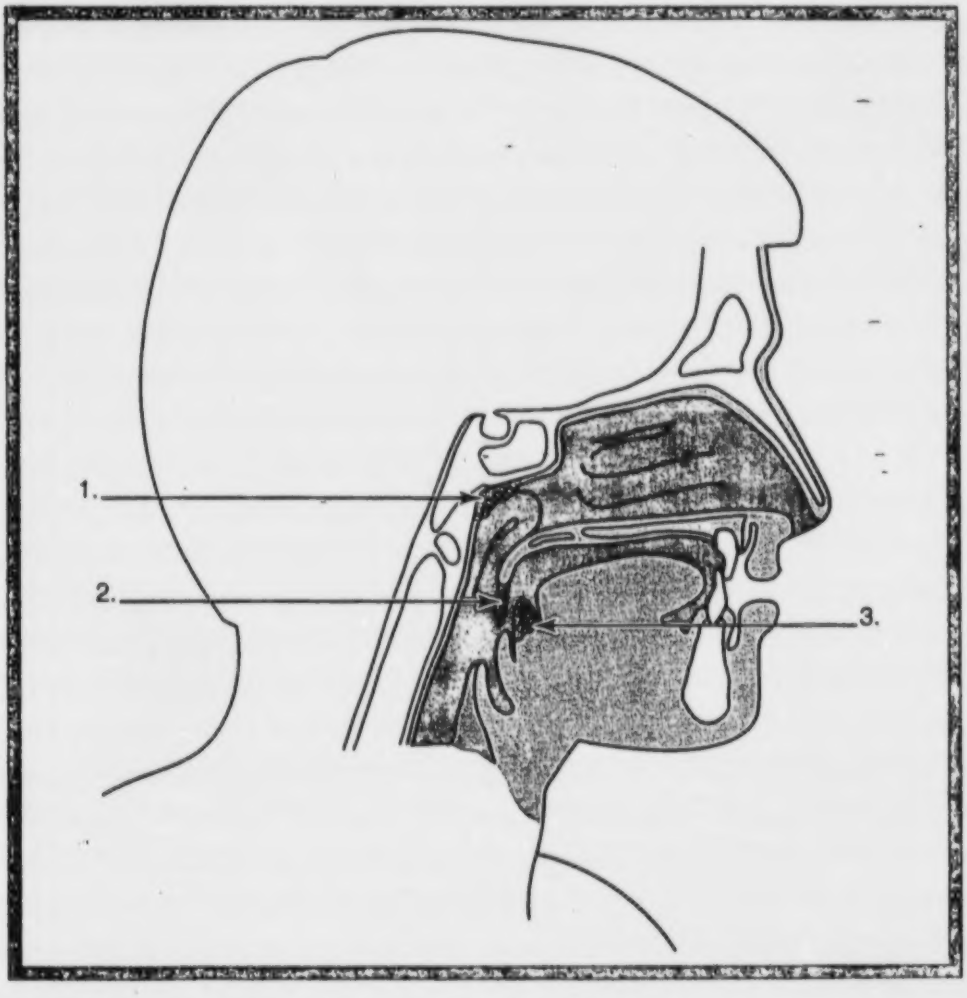
40. In the illustration below, which of the following is the correct labeling of the tonsils?

a. (1) palatine, (2) lingual, (3) pharyngeal

b. (1) lingual, (2) pharyngeal, (3) palatine

c. (1) pharyngeal, (2) palatine, (3) lingual

d. (1) pharyngeal, (2) lingual, (3) palatine



Answers to Module Review

1. c	9. b	17. a	25. c	33. b
2. b	10. a	18. d	26. a	34. c
3. a	11. b	19. c	27. b	35. c
4. c	12. c	20. b	28. a	36. b
5. b	13. c	21. a	29. b	37. d
6. c	14. a	22. d	30. a	38. c
7. a	15. d	23. d	31. c	39. d
8. b	16. d	24. b	32. a	40. c

MODULE SET II:
Major Body Systems

Module 11: Respiratory System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Respiratory System	7
2—Major Organs and Structures of the Respiratory System	9
3—Major Structures of the Bronchi	11
4—Major External Structures of the Lungs	13
5—Major Structures of the Pleura	15
Written Test	17
Answers to Written Test	31
Answers to Assignment Sheet	35
Crossword Puzzles	
1—Terms from Objectives 1 and 2	37
2—Terms from Objectives 3 and 4	39
3—Terms from Objectives 5 Through 7	41
4—Terms from Objectives 8 Through 15	43
5—Terms from Objectives 17 and 18	45
6—Terms from Objective 18 (cont.)	47
Answers to Crossword Puzzles	49
Module Review	51
Answers to Module Review	67

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activity Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✓**NOTE:** The focus of this module is the respiratory system, its organs and structures, and its purposes in performing pulmonary ventilation of the body and cellular respiration. Discuss the definitions of the terms *pulmonary ventilation* (external respiration) and *cellular respiration* (internal respiration), and lead students to understand that getting the oxygen out of the air and into the bloodstream are the processes performed by the respiratory system.

- Use crossword puzzles 1 through 6 to help reinforce the terms in the associated objectives.
- To supplement Objective 1 and to introduce the module, use the following strategies.
  - Have the students take a couple of deep breaths and then hold their breath to see how long they can do so. You may wish to instruct the students not to overdo it to the point of passing out. Have the students think about their need to breathe, how they have some control over how often and deeply they breathe, and how they will find that their bodies will take over that control to support its need for oxygen. Point out that this is the role of the respiratory system. Use a doximeter to measure the students' blood-oxygen levels and discuss the interaction of the respiratory and circulatory systems.
  - Use illustrations, models, and animal lungs to discuss the parts of the respiratory system. Give an overview of the function of each part.
- To supplement your discussion of Objective 2, use review and discussion to explore the concepts of pulmonary ventilation and cellular respiration. Help the students to understand that respiration is single process, but the mechanics of bringing oxygen into the body, absorbing it into the bloodstream, delivering it to the cells, using it in the cells, and carrying the wastes away from the cells and out of the body involve many organs and systems.
- Use the following strategies to supplement your discussion of Objective 3, which defines terms used to measure aspects of respiratory volume.
  - Discuss the process of breathing. Have the students note their resting breathing rate and then breathing rate after exercise. Have them discuss why the breathing rate would increase and how an increase in breathing rate would help deal with increased metabolism.
  - Have a respiratory therapist or physician assist with the presentation of normal respiratory factors. Conduct tests and demonstrations for the various respiratory volumes. Discuss the physiological factors that influence these conditions.

- For Objective 4, use illustrations and models to discuss the structure and functioning of the diaphragm and the ribs in breathing. A respiratory therapist or voice coach may be useful in helping the students understand the functioning of these structures.
- Use the following strategies to supplement your discussion of Objective 5 through Objective 17.
  - — Using illustrations and models, discuss the structure of the nose and nasal passages. Discuss accessory structures such as sinuses and olfactory organs. Have the students speculate on the role of cilia and mucus and the presence of so many near-surface capillaries. Have students pinch their nostrils together and talk or taste foods to determine if the nose plays a role in these functions.
  - — Use illustrations and models to discuss the structure and functioning of the pharynx and its three sections.
  - — Use illustrations and models to discuss the structure and functioning of the larynx. Have the students find their larynx and feel it as they speak at different pitches and volumes. Have a physician or other knowledgeable person discuss artificial voice boxes and tracheotomies.
  - — Use illustrations and models to discuss the structure and functioning of the trachea. Use animal tracheas to explore the structure and use of cartilage.
  - — Use illustrations and models to discuss the structure and functioning of the lungs. Allow students to dissect animal lungs. Follow the path of air through the lungs and into the bloodstream. Discuss how the components of the lungs are able to capture and separate oxygen and exhale carbon dioxide. Display a lung from a long-time smoker or other highly polluted lung.
  - — Use models to illustrate how the diaphragm and intercostals elevate and depress the ribs during breathing.
- For Objective 18, discuss the common disorders and abnormalities of the respiratory system. Provide the students with slides and specimens of lung sections with various conditions, such as tuberculosis, emphysema, etc. Discuss breathing disorders.

Resources used in developing this module

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.

- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✓**NOTE:** The following web sites focus on the respiratory system. Additional sites related to respiratory disorders are contained in Assignment Sheet 1. Resources listed in other modules provide information about the systems presented in those modules.

- http://www.ama-assn.org/insight/gen_hlth/atlas/newatlas/lung.htm

  This site provides a map of the respiratory system that will allow students to learn about the structure of the lungs and other components. The site includes interactive illustrations.

- http://library.thinkquest.org/19347/respiratory.htm

  This web site offers a number of pages that provide an overview of the respiratory system, including anatomy, physiology, diseases, and related topics.

- http://www.vilenski.com/science/humanbody/hb_html/respiratory.html

  The illustrations, links, and interesting facts provided by this web site will allow students to explore many different aspects of the respiratory system.

- http://health.yahoo.com/health/Diseases_and_Conditions/Disease_Feed_Data/Tobacco_use_smoking_and_smokeless_tobacco/index.html

  This site discusses the effects of smoking and the use of smokeless tobacco.

- http://www.smokehelp.org/html/picture_this.html

  This web page contains photographs of lungs with emphysema and cancerous lungs.

- http://www.asrt.org/

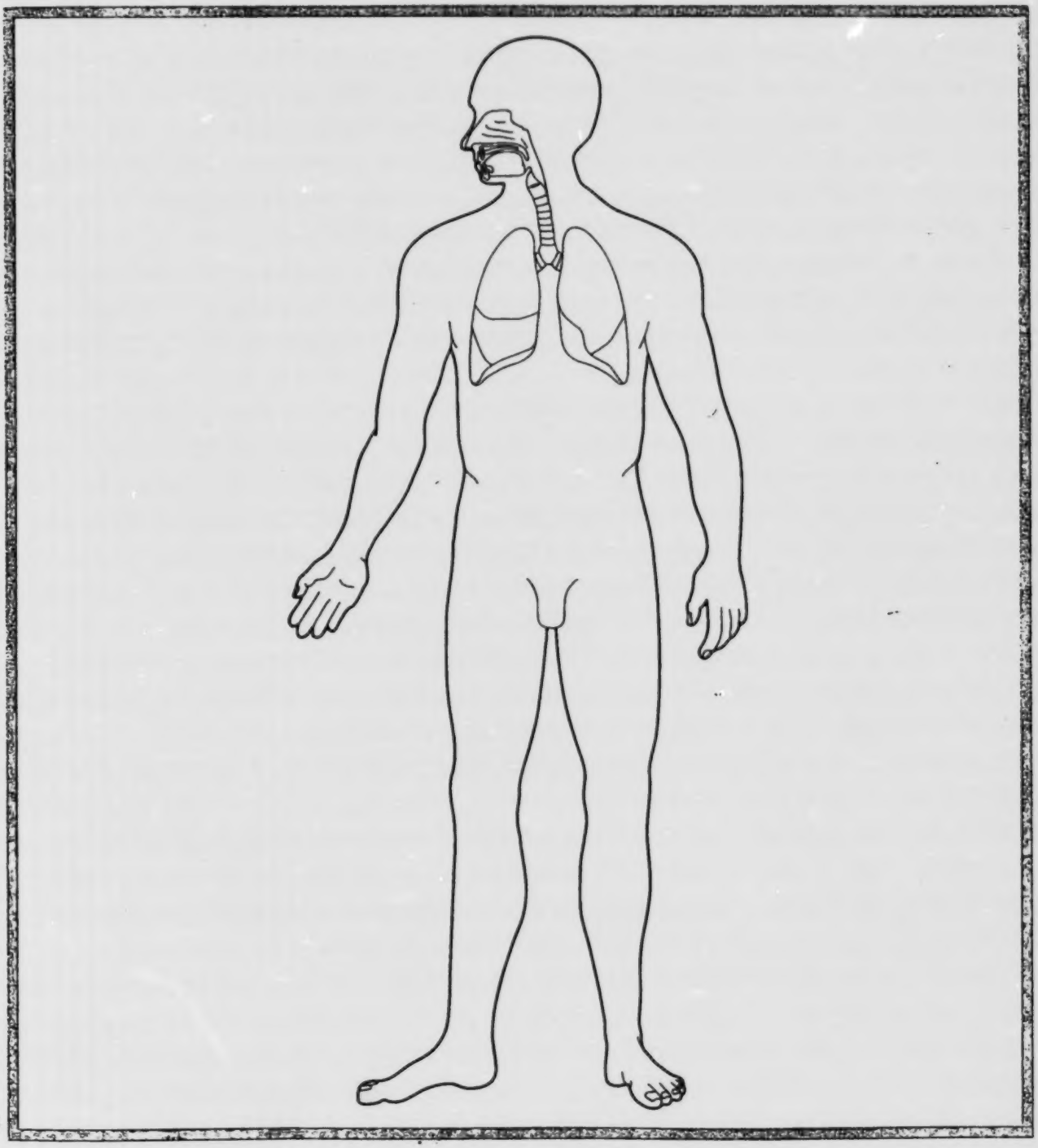
  This is the home page for the American Society of Radiation Technologists. Students will be able to search the site for imaging of various respiratory-related procedures, including chest X rays.

- http://pslgroup.com/CF.htm#Disease

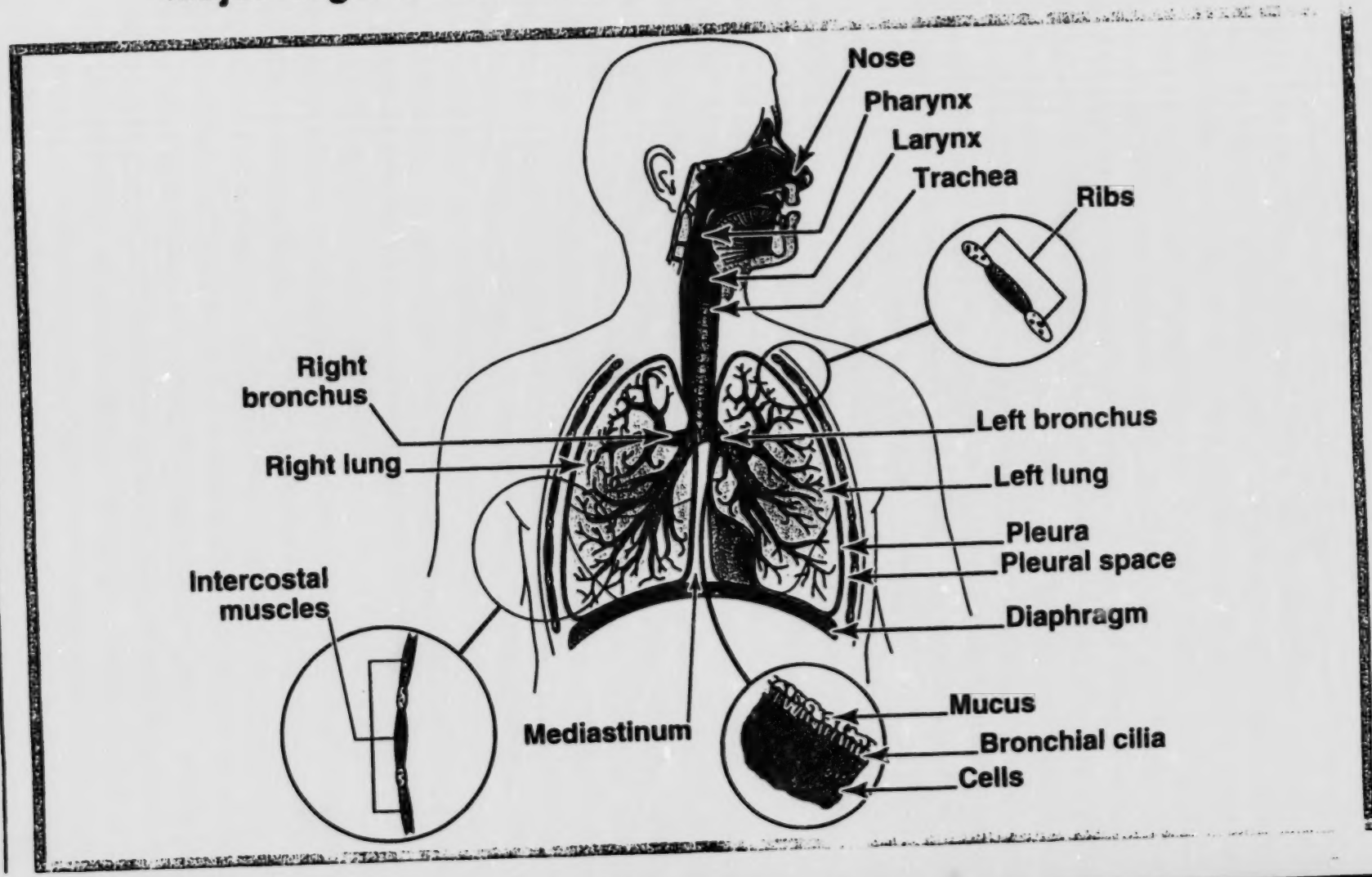
  This site focuses on cystic fibrosis.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

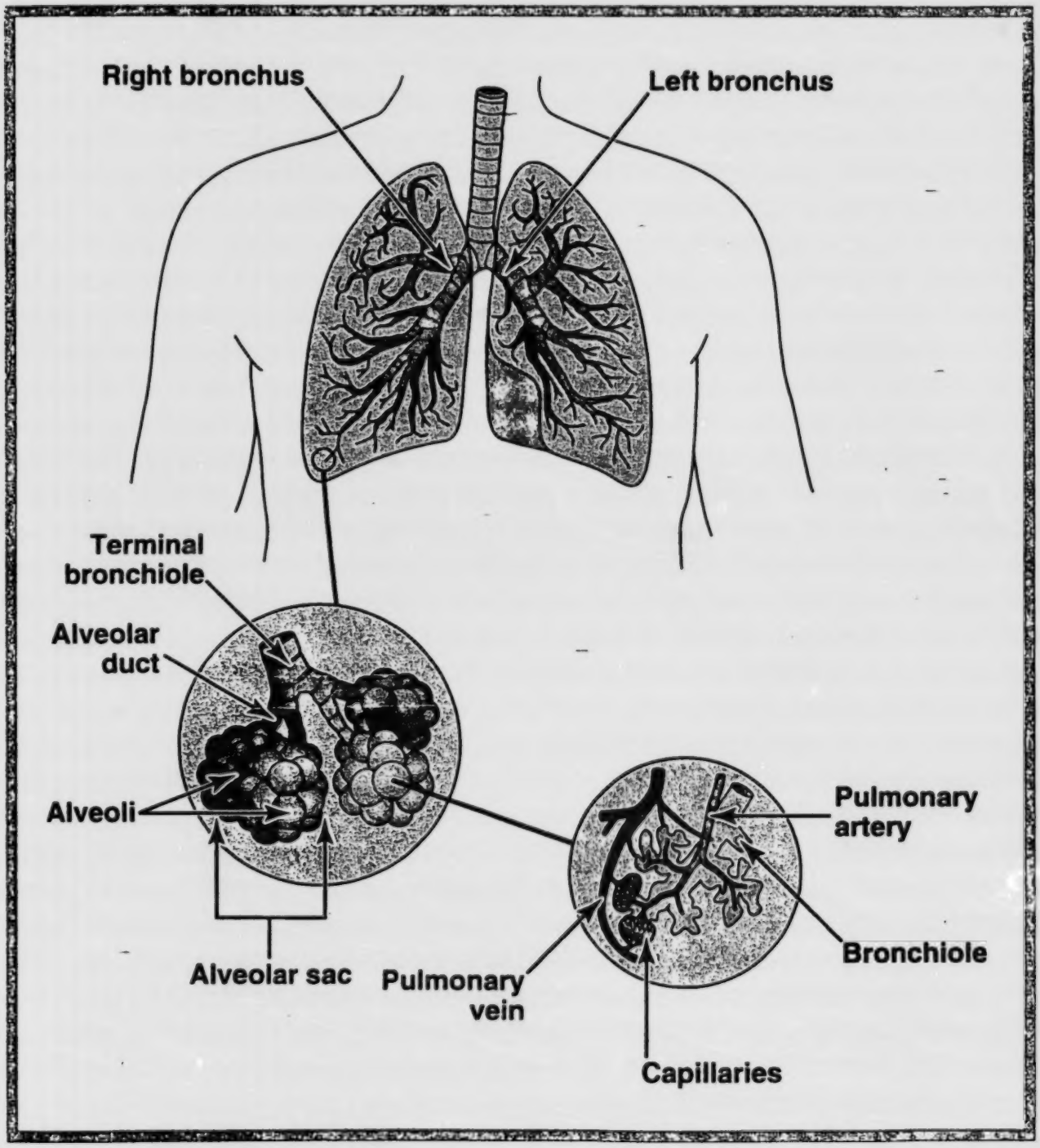
Respiratory System



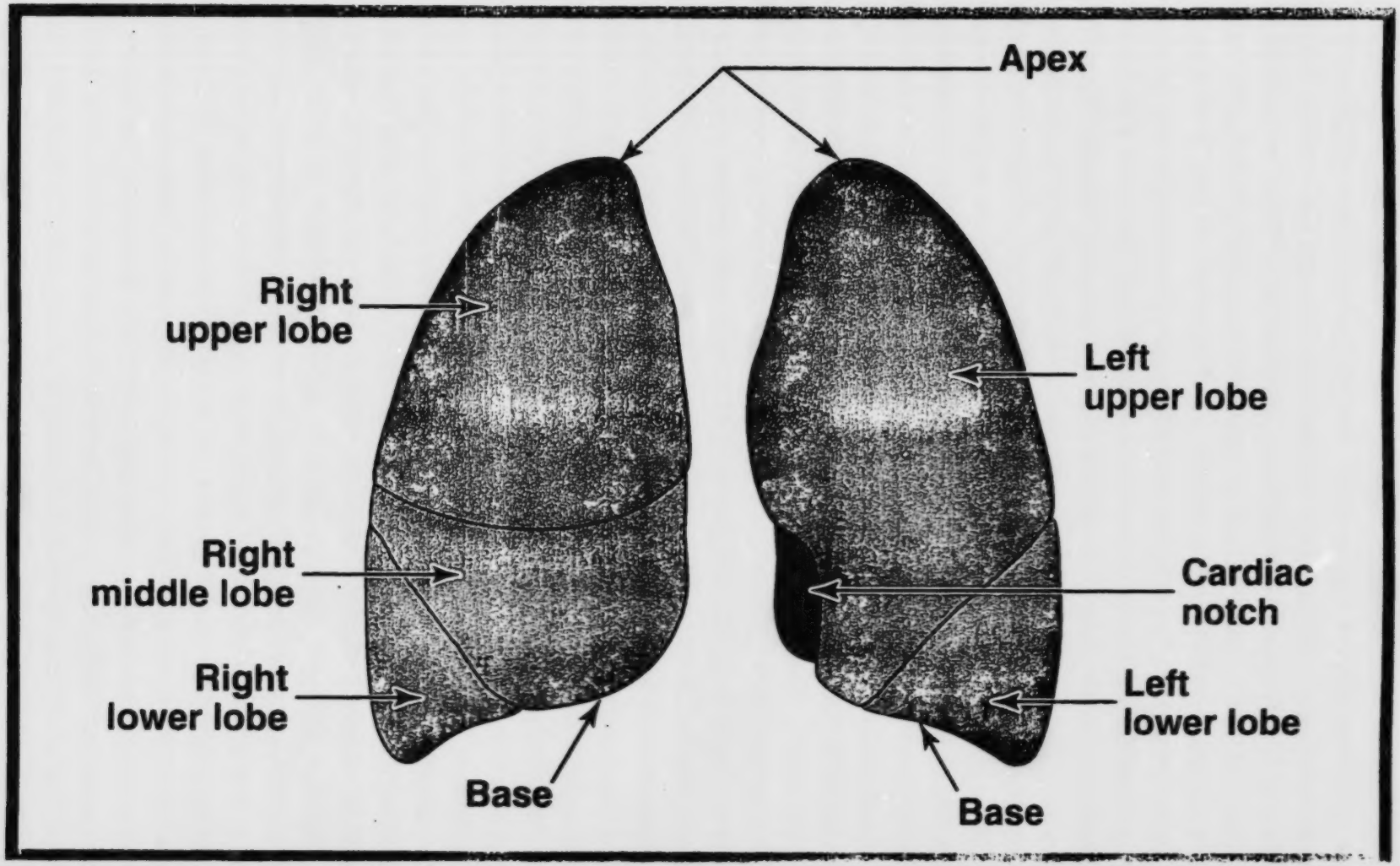
Major Organs and Structures of the Respiratory System



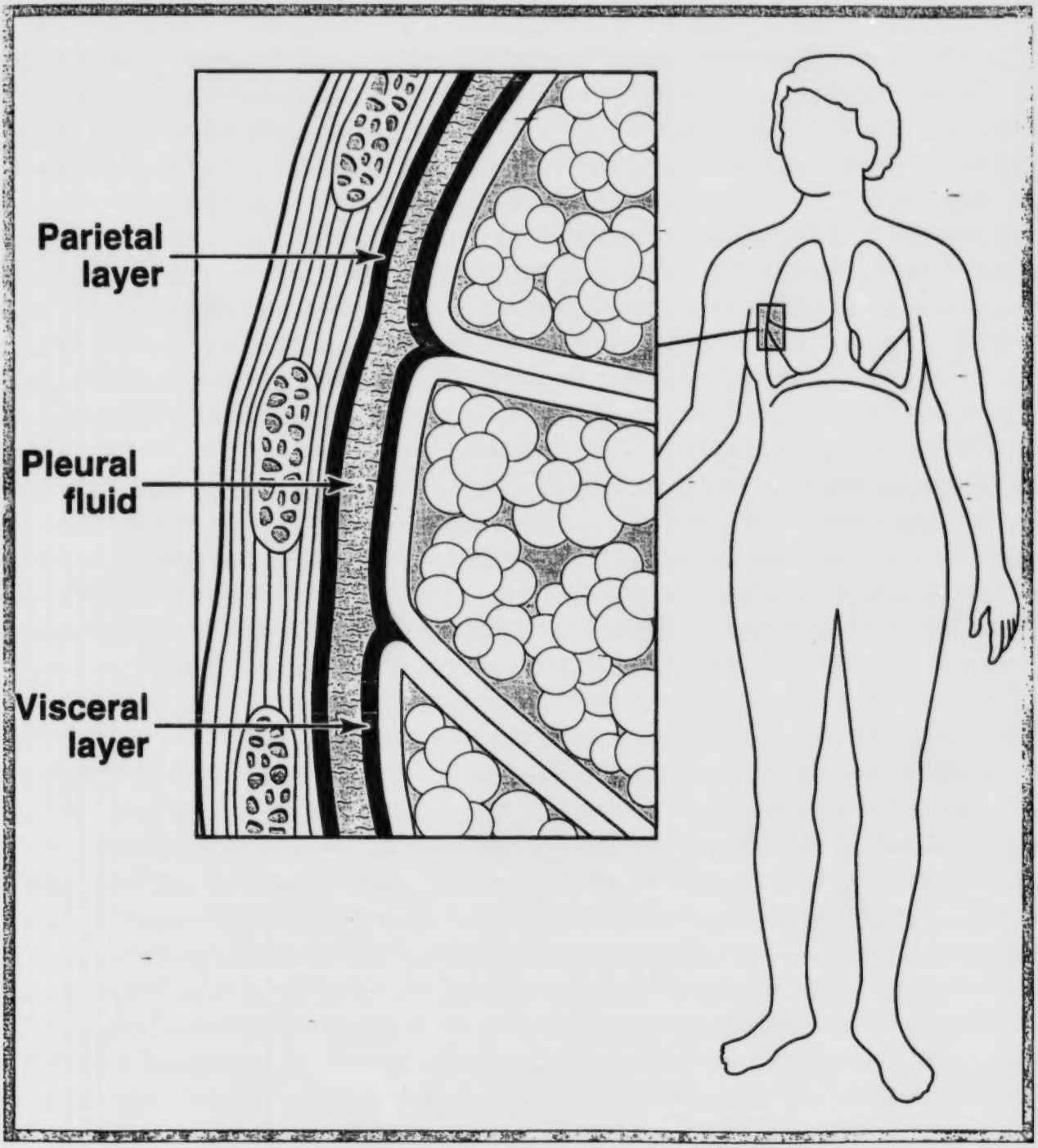
Major Structures of the Bronchi



Major External Structures of the Lungs



Major Structures of the Pleura



Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *respiratory system*. Write your answer on the blank lines provided beside the term below.

Respiratory system _____

_____

Objective 2 Complete statements that describe the characteristics of pulmonary ventilation. Write your answers on the blank lines provided in the statements below.

a. The _____ portion of pulmonary ventilation is referred to as *breathing*.

b. There are two stages to breathing: _____ and _____.

c. Breathing is controlled by the _____ and the _____ of the brainstem.

d. The brain sends impulses down the spinal cord to the phrenic nerve and out to the _____.

e. If the _____ is severed in the cervical area or if the phrenic nerve is severed, respiration will cease.

f. The medulla is governed by variations in the chemistry of the blood that are detected by chemoreceptors in the _____ and the _____.

g. The major regulator of respiration is the carbon-dioxide level in the blood; high concentrations of carbon dioxide _____ the rate of respiration, while decreased concentrations of carbon dioxide _____ the rate of respiration.

h. Normal pulmonary ventilation occurs at a rate of _____ to _____ times per minute.

Module 11: Respiratory System

Objective 3 Define terms used to measure the various aspects of respiratory volume. Write your answers on the blank lines provided beside each of the terms below.

a. Tidal volume _____

_____

b. Minute respiratory volume _____

_____

c. Inspiratory volume _____

_____

d. Expiratory volume _____

_____

e. Vital capacity _____

_____

f. Residual air _____

_____

Objective 4 Complete statements that describe the portions of the thorax that are related to the lungs. Write your answers on the blank lines provided in the statements below.

a. The thorax, which is also called the _____, is the part of the body between the neck and the abdomen; it is the cavity where the heart and lungs lie.

b. The _____ is the cavity within the thorax that contains the lungs.

c. The _____ is the space in the thorax between the two lungs.

Objective 5 Define the major organs and structures of the respiratory system. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Nose _____

_____

_____

b. Pharynx _____

c. Larynx _____

d. Trachea _____

e. Bronchi _____

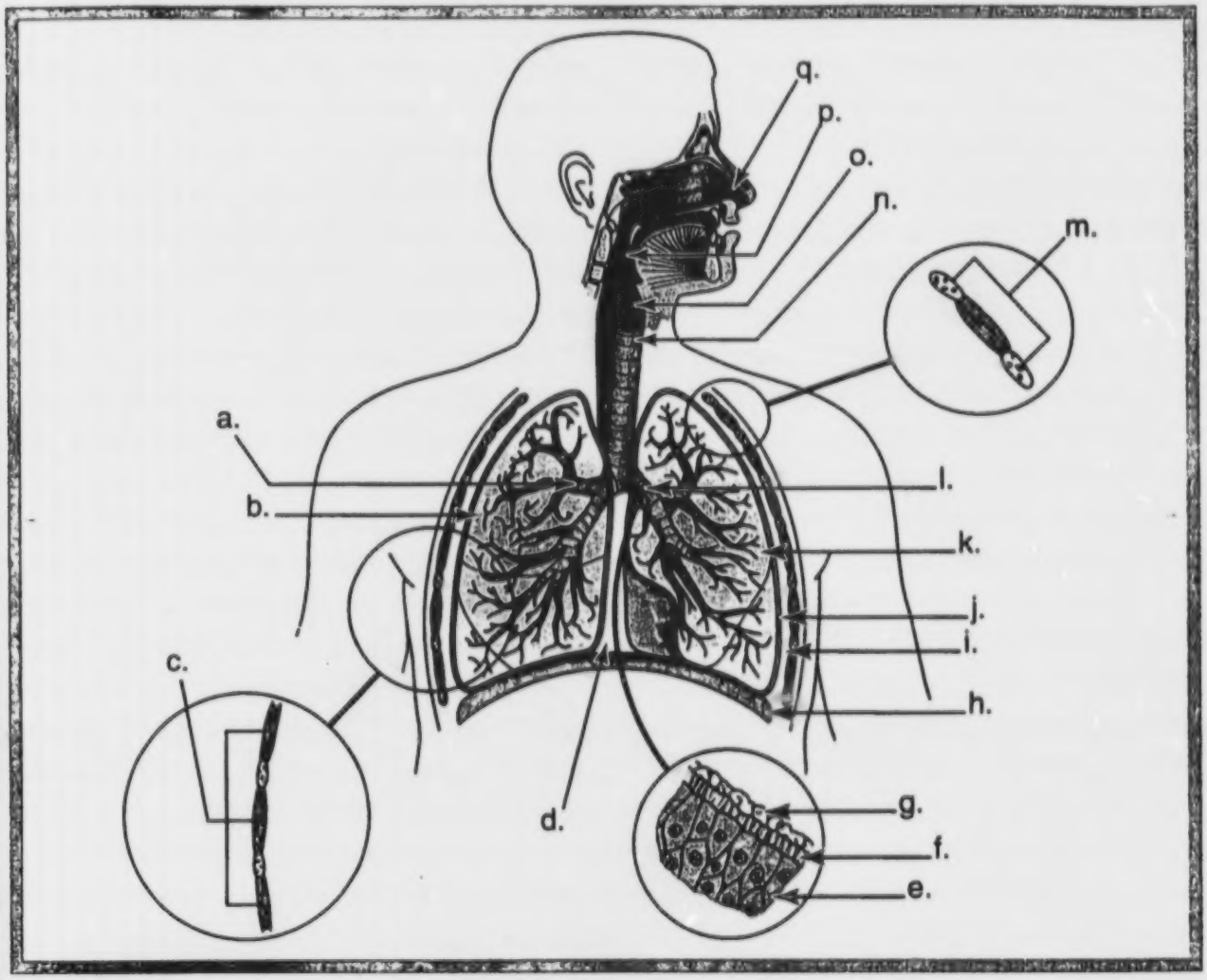
f. Lungs _____

g. Pleura _____

h. Diaphragm _____

i. Intercostal muscles _____

Objective 6 | Label the major organs and structures of the respiratory system. Write your answers on the blank lines provided below the following illustration.



a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____
h. _____
i. _____
j. _____
k. _____
l. _____
m. _____
n. _____
o. _____
p. _____
q. _____

Objective 7

Complete statements that describe the characteristics and structures of the nose that are related to the respiratory system. Write your answers on the blank lines provided in the statements below.

a. The nose serves as a passageway for air going to the _____.

b. The nose _____, _____, and _____ air passing into it.

c. The openings in the front of the nose are known as *nostrils* or _____.

d. The nose consists of two nasal cavities; the nasal cavities lie between the _____ and the _____.

e. The nasal cavities are separated by a vertical partition known as the _____.

f. The nasal cavities are constructed of bone covered by _____.

g. On the side walls of the nasal cavities are three projections known as _____ or _____ that greatly increase the surface area over which air must travel before reaching the lungs.

h. The _____ of the nose are very vascular because they contain many blood vessels that bring warmth and moisture to these surfaces.

i. The _____—the cavities in the various bones of the skull that are continuous with the nasal cavity—may also function to warm, moisten, and filter air before it enters the rest of the respiratory system, but the purpose of these cavities is not clear.

Objective 8

Complete statements that describe the characteristics of the pharynx that are related to the respiratory system. Write your answers on the blank lines provided in the statements below and on the next page.

a. The pharynx is about _____ inches long and is composed of muscle lined with mucous membrane.

b. The pharynx passes air from the nasal cavities to the _____.

c. The pharynx consists of three divisions: the _____, the _____, and the _____.

d. The _____ is the upper portion of the pharynx that lies behind the nose and above the palate.

e. The _____ is the middle portion of the pharynx that lies behind the mouth and between the palate and the hyoid bone.

f. The _____ is the lower portion of the pharynx that lies immediately below the hyoid bone and above the larynx.

OBJECTIVE 9

Complete statements that describe the characteristics and structures of the larynx that are related to the respiratory system. Write your answers on the blank lines provided in the statements below.

a. The larynx is shaped like a triangular box with _____ sides and a _____ in front.

b. The larynx consists of nine pieces of _____ that are connected by ligaments and are moved by various muscles.

c. The three prominent cartilages of the larynx are the _____, the _____, and the _____.

d. The _____ is the largest and is commonly called the *Adam's apple*; this cartilage is usually larger in men than in women.

e. The _____ covers the entrance into the larynx during swallowing, thus preventing food or liquids from entering the airway.

f. The _____ is the lowest of the cartilage structures and has the appearance of a signet ring.

OBJECTIVE 10

Complete statements that describe the characteristics and structures of the trachea. Write your answers on the blank lines provided in the statements below and on the next page.

a. The trachea is about _____ inches long and about 1 inch from side to side.

b. The trachea is a tube of _____ muscle lined with _____ membrane.

c. The muscle tissue is strengthened and held open by 16 to 20 C-shaped rings of _____ cartilage, each with the open portion of the C toward the posterior near the _____.

OBJECTIVE 11

Complete statements that describe the characteristics and structures of the bronchi. Write your answers on the blank lines provided in the statements below.

a. The bronchi consist of two primary bronchi: the _____ bronchus and the _____ bronchus.

b. The _____ bronchus is shorter and more vertical than the _____ bronchus.

c. The structure of the bronchi resembles the trachea as the walls contain _____ and _____ lining.

d. Each bronchus enters the lung at the notch or depression on the medial surface called the _____ or _____.

e. Each primary bronchus enters the lung on its respective side and immediately subdivides into smaller branches called _____.

f. _____ continue to branch, forming small bronchioles, which lack _____.

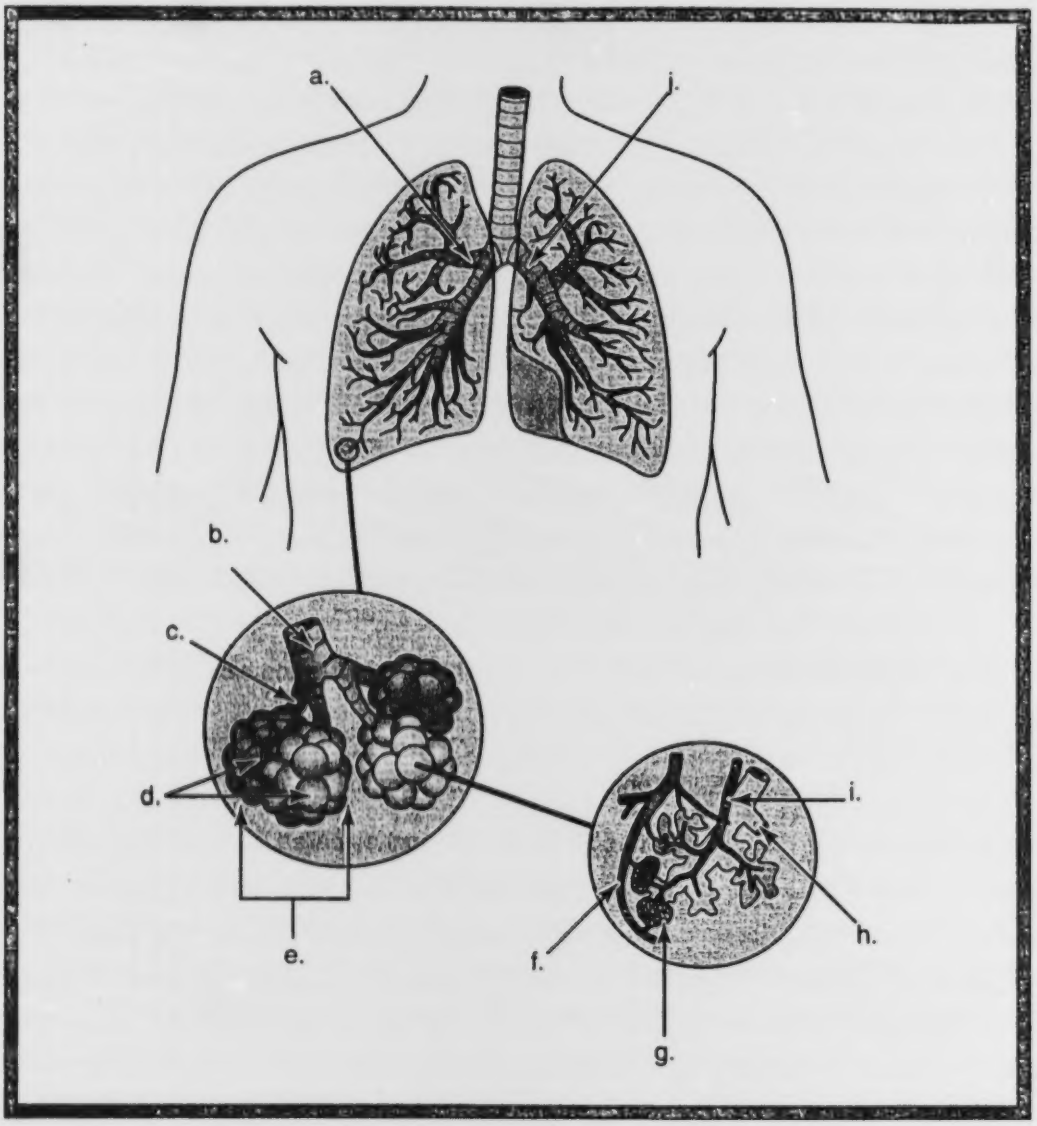
g. The bronchioles subdivide into smaller and smaller tubes, eventually ending in microscopic branches that divide into _____, ending in several _____ that consist of numerous alveoli.

h. Alveolar ducts and sacs look like a cluster of grapes with the stem as the _____, each cluster as an _____, and each grape as an _____.

i. The _____ are enveloped by networks of capillaries that provide spaces where gaseous exchange between the air and the blood can occur.

Objective 12

Label the major structures of the bronchi. Write your answers on the blank lines provided below the following illustration.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____ j. _____

Objective 13

Complete statements that describe the characteristics and structures of the lungs. Write your answers on the blank lines provided in the statements below.

a. The two lungs rest side by side and extend from the _____ to a point slightly above the _____ and lie against the _____ at the anterior and posterior.

b. The medial surface of each lung is _____ to allow room for the mediastinal structures and the heart.

c. The lung root attaches to the _____ and is composed of all the structures entering and leaving the lung, including the primary bronchi, the pulmonary arteries and veins, the bronchial arteries and veins, the lymph vessels and nodes, and the nerves.

d. The _____ of a lung is the pointed upper margin that extends slightly above the clavicle.

e. The _____ of a lung is the broad, inferior surface that lies on the diaphragm.

f. The left lung has an indentation for the heart called the _____.

g. The _____ lung is slightly larger, heavier, and shorter (by about 1 inch) than the _____ lung.

h. The right lung is divided into three lobes: the _____ lobe, the _____ lobe, and the _____ lobe.

i. The left lung is divided into two lobes: the _____ lobe and the _____ lobe .

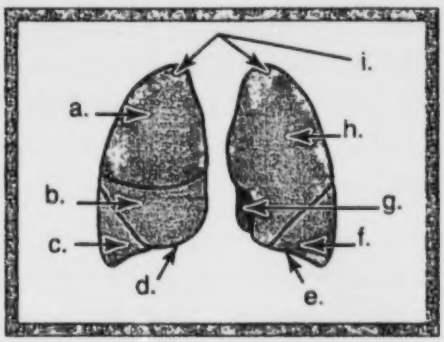
j. At birth, a person's lungs are _____, but with age they become a mottled-gray color due to the inhalation of dust, pollution, and smoke.

k. When filled to capacity, a lung can hold approximately _____ cubic inches of air, though only _____ cubic inches are inhaled and exhaled in a normal breath.

l. The lungs act as an _____ organ in that a person loses about 24 cubic inches of moisture per day in expired air.

Objective 14

Label the major external structures of the lungs. Write your answers on the blank lines provided below the following illustration.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____

Objective 15

Complete statements that describe the characteristics and structures of the pleura. Write your answers on the blank lines provided in the statements below.

a. The pleura divides into the _____ pleura and the _____ pleura.

b. The _____ pleura covers the lung and dips into the fissures between the lobes.

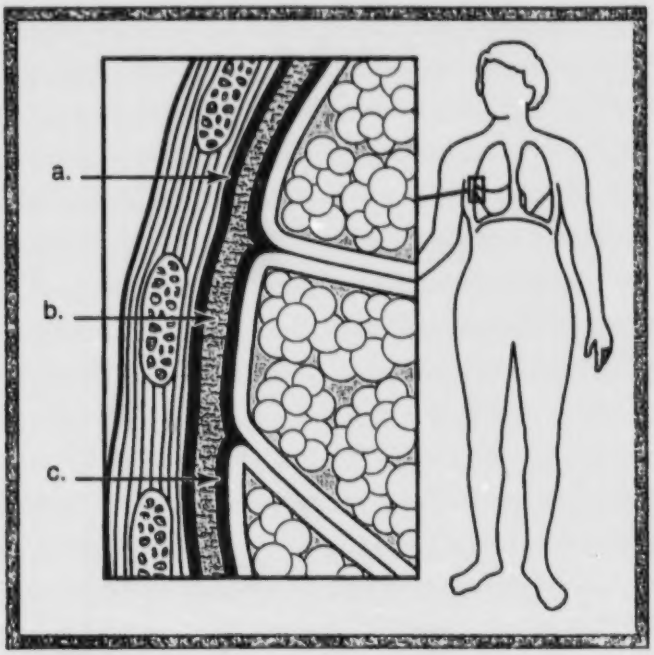
c. The _____ pleura lines the chest wall, covers the diaphragm, and reflects over the structures in the mediastinum.

d. The _____ and _____ pleurae are separated from each other by a small amount of fluid—_____ fluid—that acts as a lubricant as the lungs expand and contract during respiration.

e. _____ fluid is secreted by the serous membrane.

f. Excess secretion of _____ fluid results in pleural _____.

Objective 16 Label the major structures of the pleura. Write your answers on the blank lines provided below the following illustration.



a. _____ c. _____

b. _____

Objective 17 Complete statements that describe the muscles that change the size of the thorax. Write your answers on the blank lines provided in the statements below.

a. The diaphragm is the _____ muscle of breathing.

b. On _____, the diaphragm contracts, flattens, and moves downward to enlarge the thoracic cavity.

c On _____, the diaphragm relaxes and moves upward to decrease the size of the thoracic cavity.

d. The intercostal muscles are the _____ muscles of breathing.

e. The intercostal muscles are designated as _____ and _____.

f. The _____ intercostals elevate the ribs.

g. The _____ intercostals depress the ribs.

Objective 18

Match common disorders and abnormalities of the respiratory system to their correct definitions. Write the numbers on the blanks provided below and on the next page.

_____ a. The condition characterized by bluish-gray discoloration of the skin and mucous membranes as a result of insufficient oxygen

_____ b. A condition of increased carbon dioxide and decreased oxygen in the body as a result of diminished respiration

_____ c. Painful, difficult, and labored respiration

_____ d. The transient cessation of breathing

_____ e. A malignancy seated in the pulmonary tissue, generally affecting lungs damaged by disease, pollutants, or smoking

_____ f. An acute or chronic inflammation of the bronchial tree, often as a result of infection

_____ g. An inflammation or infection of the larynx, usually accompanied by edema of the vocal cords with hoarseness of loss of the voice

_____ h. An abnormal condition characterized by a lack of oxygen

_____ i. A condition in premature infants whose lungs have not developed enough to allow inflation of the alveoli

_____ j. A respiratory disorder characterized by constriction of the bronchioles, excessive production of mucus, and difficult breathing

_____ k. An increased rate of respiration, often with deep inspirations

_____ l. A shift in the partition of the nasal cavity

_____ m. The condition resulting from inadequate oxygen reaching the cells

_____ n. The deterioration of alveoli and reduced elasticity of the lungs, leading to impairment of normal gas exchange

_____ o. An abnormal pattern of respiration characterized by alternating periods of apnea and deep, rapid breathing

_____ p. A condition in which fluid accumulates around the vocal cords

1. Anoxia
2. Apnea
3. Asphyxia
4. Asthma
5. Bronchitis
6. Cheyne-Stokes respiration (CSR)
7. Cyanosis
8. Deviated nasal septum
9. Dyspnea
10. Emphysema
11. Hyaline membrane disease
12. Hypernea
13. Hypoxia
14. Laryngeal edema
15. Laryngitis
16. Lung cancer

_____ q. An infection of the mucosa of the nose, pharynx, or larynx

_____ r. Any of various conditions in which the mechanics of respiration fail to inflate the alveoli

_____ s. An inflammation or infection of the pharynx, usually causing symptoms of a sore throat

_____ t. An acute inflammation of the lungs usually caused by a bacterial infection

_____ u. An inflammation of the mucous membranes of the nasal cavities generally accompanied by swelling of the mucosa and a nasal discharge

_____ v. An interruption in breathing with oxygen deprivation usually caused by an obstruction in the airways

_____ w. A collection of air or gas in the pleural space causing the lung to collapse

_____ x. A condition in which fluid accumulates in lung tissues and in the alveoli

_____ y. A chronic, highly contagious infection of the lungs from the bacillus *Mycobacterium tuberculosis*

17. Pharyngitis
18. Pneumonia
19. Pneumothorax
20. Pulmonary edema
21. Respiratory distress
22. Rhinitis
23. Suffocation
24. Tuberculosis
25. Upper respiratory infection

Answers to Written Test

Objective 1

The complex of organs and structures that performs the pulmonary ventilation of the body and cellular respiration

Objective 2

a. mechanical
b. inhalation (inspiration); exhalation (expiration)
c. medulla oblongata; pons
d. diaphragm
e. brainstem
f. carotid body; aortic arch
g. increase; slow
h. 14; 20

Objective 3

a. The amount of air involved in one respiration cycle, totaling approximately 1 pint (500 milliliters)

b. The amount of air inhaled and exhaled during a one-minute period, averaging approximately 6 quarts (6000 milliliters or 6 liters)

c. The amount of air that can be taken in with the deepest possible inhalation beyond tidal volume, amounting to 2 to 3 quarts (2000 to 3000 milliliters)

d. The amount of air that can be expelled with the most-forceful exhalation possible beyond tidal volume, amounting to 1 to 1½ quarts (1000 to 1500 milliliters)

e. The total respiration volume calculated as the sum of tidal volume, inspiratory volume, and expiratory volume, totaling 3½ to 5 quarts (3500 to 5000 milliliters)

f. The amount of air that remains in the lungs after the most-forceful expiration, amounting to 1 to 1½ quarts (1000 to 1500 milliliters)

Objective 4

a. chest
b. pleural cavity
c. mediastinum

Objective 5

a. The structure that protrudes from the anterior portion of the skull and serves as part of the passageway for air to and from the lungs

b. The throat; the muscular, tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for both the respiratory and digestive tracts

c. The organ of voice that is part of the air passageway connecting the pharynx with the trachea

d. The windpipe; the nearly cylindrical tube in the neck that extends from the lower end of the larynx to the point where it divides into the two bronchi of the lungs

e. The large air passages in the lungs through which pass inspired air and exhaled waste gases

f. The two light, spongy, highly elastic, saccular organs located in the thoracic cavity and constituting the main components of the respiratory system for inspiring air and exhaling carbon dioxide

g. The delicate serous membrane that lines each half of the thorax and is folded over the surface of the lung on the same side

h. The dome-shaped partition of muscle and connective tissue that separates the thoracic and the abdominal cavities and aids respiration by moving up and down

i. The muscles between the ribs

Objective 6

a. Right bronchus
b. Right lung
c. Intercostal muscles
d. Mediastinum
e. Cells
f. Bronchial cilia
g. Mucus
h. Diaphragm
i. Pleural space
j. Pleura
k. Left lung
l. Left bronchus
m. Ribs
n. Trachea
o. Larynx
p. Pharynx
q. Nose

Objective 7

a. lungs
b. warms; moistens; filters
c. anterior nares
d. roof of the mouth; cranium
e. nasal septum
f. ciliated mucous membranes
g. nasal conchae; turbinates
h. mucous membranes
i. nasal sinuses

Objective 8

a. 5
b. larynx
c. nasopharynx; oropharynx; laryngopharynx
d. nasopharynx
e. oropharynx
f. laryngopharynx

Objective 9

a. flat; prominent ridge
b. cartilage
c. thyroid cartilage; epiglottis; cricoid cartilage
d. thyroid cartilage
e. epiglottis
f. cricoid cartilage

Objective 10

a. 4½
b. smooth; mucous
c. hyaline; esophagus

Objective 11

a. right; left
b. right; left
c. cartilage rings; ciliated mucous
d. hilus; hilum
e. secondary bronchi
f. Secondary bronchi; cartilage
g. alveolar ducts; alveolar sacs
h. alveolar duct; alveolar sac; alveolus
i. alveoli

Objective 12

a. Right bronchus
b. Terminal bronchiole
c. Alveolar duct
d. Alveoli
e. Alveolar sac
f. Pulmonary vein
g. Capillaries
h. Bronchiole
i. Pulmonary artery
j. Left bronchus

Objective 13

a. diaphragm; clavicles; ribs
b. concave
c. mediastinum
d. apex
e. base
f. cardiac notch (cardiac depression)
g. right; left
h. upper; middle; lower
i. upper; lower
j. pink
k. 275; 30
l. excretory

Objective 14

a. Right upper lobe
b. Right middle lobe
c. Right lower lobe
d. Base
e. Base
f. Left lower lobe
g. Cardiac notch
h. Left upper lobe
i. Apex

Objective 15

a. visceral; parietal
b. visceral
c. parietal
d. parietal; visceral; pleural
e. Pleural
f. pleural; effusion

Objective 16

a. Parietal layer
b. Pleural fluid
c. Visceral layer

Objective 17

a. primary
b. inspiration
c. expiration
d. secondary
e. external; internal
f. external
g. internal

Objective 18

a. 7	f. 5	k. 12	p. 14	u. 22
b. 3	g. 15	l. 8	q. 25	v. 23
c. 9	h. 1	m. 13	r. 21	w. 19
d. 2	i. 11	n. 10	s. 17	x. 20
e. 16	j. 4	o. 6	t. 18	y. 24

Answers to Assignment Sheet

Assignment Sheet 1

Suggested answers

INVESTIGATION POINT 1

The student's answer should include several of the following end-stage lung diseases and related problems: obstructive lung disease, cystic fibrosis, pulmonary hypertension, pulmonary fibrosis, emphysema, sarcoidosis, eosinophilic granuloma, extrinsic allergic alveolitis, lymphangioleimyomatosis, and severe bronchiectasis.

INVESTIGATION POINT 2

Tests may include blood tests; urine, stool, and sputum samples; tests to evaluate the status of the lung disease and the condition of the patient's heart, such as a chest X ray, a chest CT scan, a ventilation/perfusion scan, and echocardiogram, and electrocardiogram and a radionuclide ventriculogram; possible cardiac catheterization to ensure that there are not blockages to blood flow to the heart and also to measure the blood pressure in the pulmonary arteries; and tests for arterial blood gases and pulmonary function tests.

INVESTIGATION POINT 3

Rejection is basically the response of the immune system to what it perceives as a foreign organism in the implanted organ. There are anti-rejection drugs that help reduce the immune response. Rejection response will occur in virtually all transplants. In approximately 50 percent of the cases, rejection cannot be overcome with medication. Rejection tends to be less common in conditions such as obstructive lung disease.

INVESTIGATION POINT 4

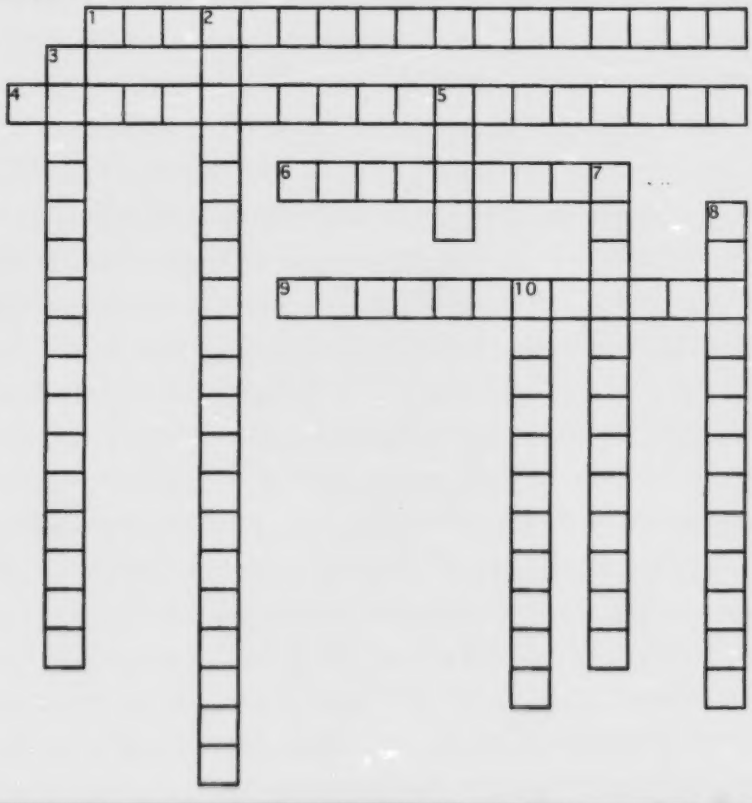
Answer will depend on the complication chosen or assigned.

INVESTIGATION POINT 5

The answer will depend on the student's interpretation of the data presented by the various sites. Key points that the student should make are that the patient should stop smoking. Second, if a transplant is performed, it is a treatment and not a cure. Factors that contributed to the emphysema may still be present in the patient's life and some effects are irreversible. Students may choose to point out that preparatory tests may reveal reasons for not doing the procedure.

Crossword Puzzle 1—Terms from Objectives 1 and 2

Name _____ Date _____



ACROSS

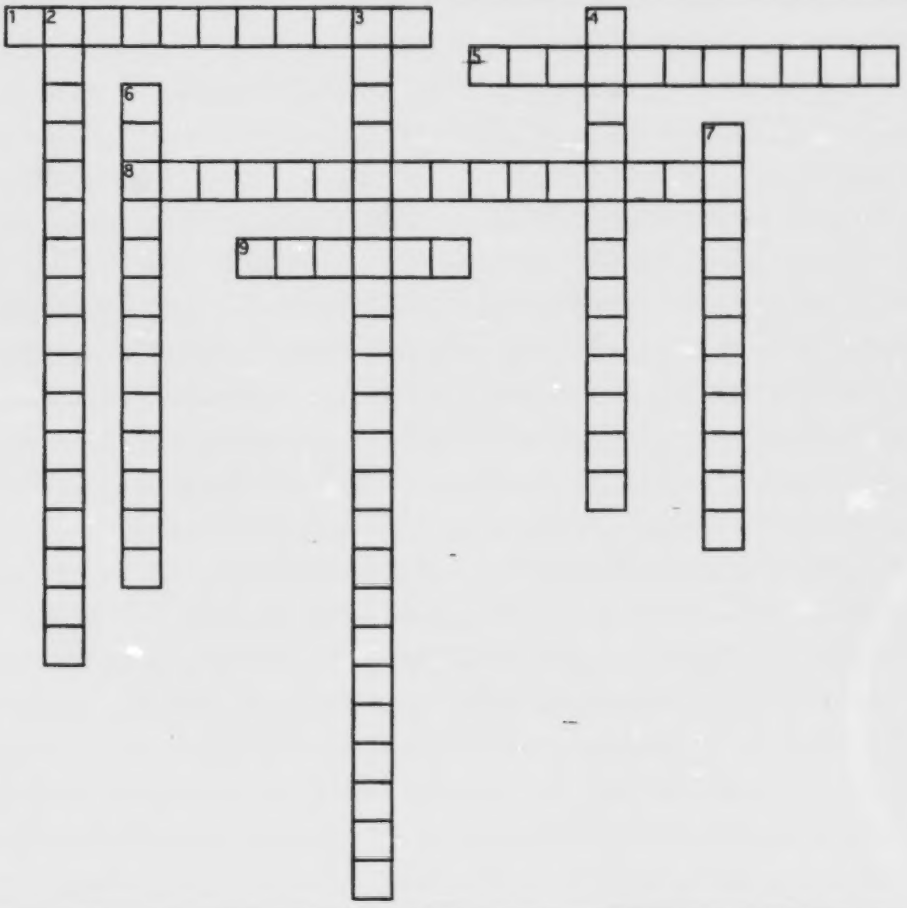
1. The complex of organs and structures that performs the pulmonary ventilation of the body and cellular respiration (2 words)
4. The process of oxygen carried by the blood passing into the cells and being used by the cells, which leads to the production of carbon dioxide that is then carried away by the blood; also called *internal respiration* (2 words)
6. The part of the brain composed of the mesencephalon, pons, and medulla oblongata and connecting the spinal cord with the forebrain and cerebrum
9. The motor nerve to the diaphragm (2 words)

DOWN

2. The process of inhaling and exhaling air through the lungs; breathing; also called *external respiration* (2 words)
3. One of the three parts of the brainstem that contains the cardiac, vasomotor, and the respiratory centers of the brain (2 words)
5. A broad mass of nerve fibers conspicuous on the ventral surface of the brainstem
7. One of the three parts of the brainstem, lying just below the cerebrum and just above the pons
8. A sensory nerve cell activated by chemical stimuli, such as a chemoreceptor in the carotid artery that is sensitive to a chemical in the blood that signals the respiratory center in the brain to increase or decrease respiration
10. A small structure containing neural tissue at the bifurcation of the carotid arteries (2 words)

Crossword Puzzle 2—Terms from Objectives 3 and 4

Name _____ Date _____



ACROSS

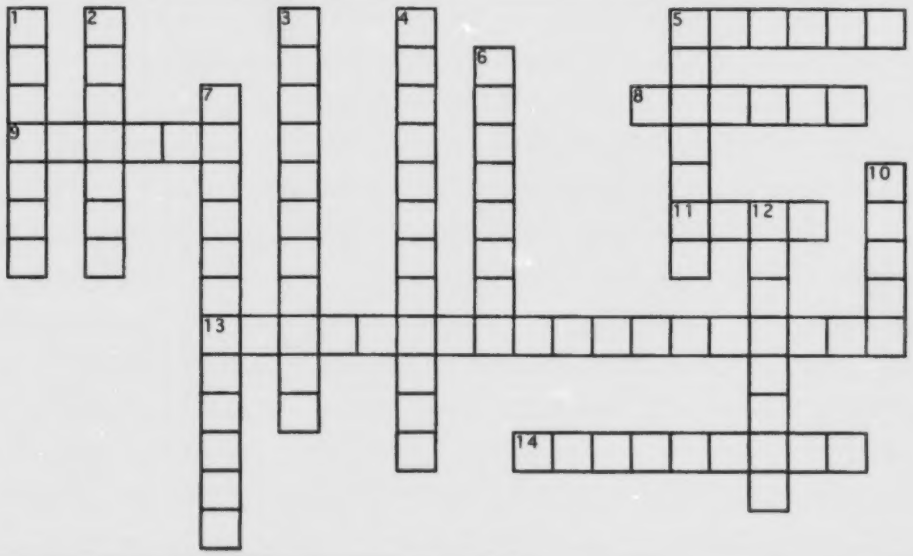
1. The amount of air involved in one respiration cycle, totaling approximately 1 pint (2 words)
5. The amount of air that remains in the lungs after the most-forceful expiration, amounting to 1 to 1½ quarts (2 words)
8. The amount of air that can be expelled with the most-forceful exhalation possible beyond tidal volume, amounting to 1 to 1½ quarts (2 words)
9. The part of the body between the neck and the abdomen; it is the cavity where the heart and lungs lie; also called the *chest*

DOWN

2. The amount of air that can be taken in with the deepest possible inhalation beyond tidal volume, amounting to 2 to 3 quarts (2 words)
3. The amount of air inhaled and exhaled during a one-minute period, averaging approximately 6 quarts (3 words)
4. The total respiration volume calculated as the sum of tidal volume, inspiratory volume, and expiratory volume, totaling 3½ to 5 quarts (2 words)
6. The cavity within the thorax that contains the lungs (2 words)
7. The space in the thorax between the two lungs

Crossword Puzzle 3—Terms from Objectives 5 Through 7

Name _____ Date _____



ACROSS

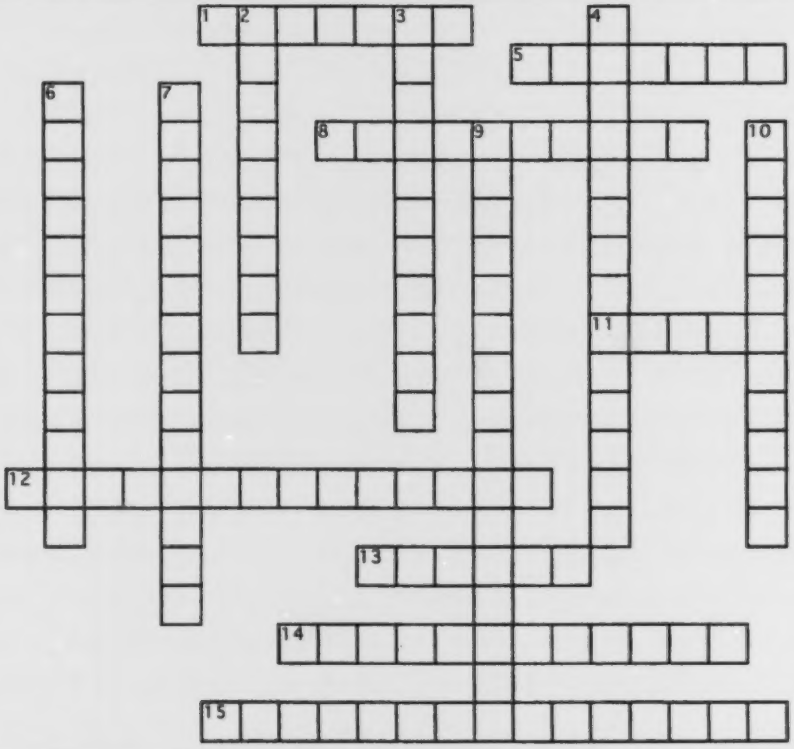
5. The delicate serous membrane that lines each half of the thorax and is folded over the surface of the lung on the same side
8. The organ of voice that is part of the air passageway connecting the pharynx with the trachea
9. Something shaped like a shell
11. The structure that protrudes from the anterior portion of the skull and serves as part of the passageway for air to and from the lungs
13. The muscles between the ribs (2 words)
14. The dome-shaped partition of muscle and connective tissue that separates the thoracic and the abdominal cavities and aids respiration by moving up and down

DOWN

1. The windpipe; the nearly cylindrical tube in the neck that extends from the lower end of the larynx to the point where it divides into the two bronchi of the lungs
2. The large air passages in the lungs through which pass inspired air and exhaled waste gases
3. A vertical partition that separates the nasal cavities (2 words)
4. The three projections on the side walls of the nasal cavities that greatly increase the surface area over which air must travel before reaching the lungs; also called *turbinates* (2 words)
5. The throat; the muscular, tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for both the respiratory and digestive tracts
6. The openings in the front of the nose; also called *anterior nares*
7. The cavities in the various bones of the skull that are continuous with the nasal cavity (2 words)
10. The two light, spongy, highly elastic, saccular organs located in the thoracic cavity and constituting the main components of the respiratory system for inspiring air and exhaling carbon dioxide
12. Resembling a sac

Crossword Puzzle 4—Terms from Objectives 8 Through 15

Name _____ Date _____



ACROSS

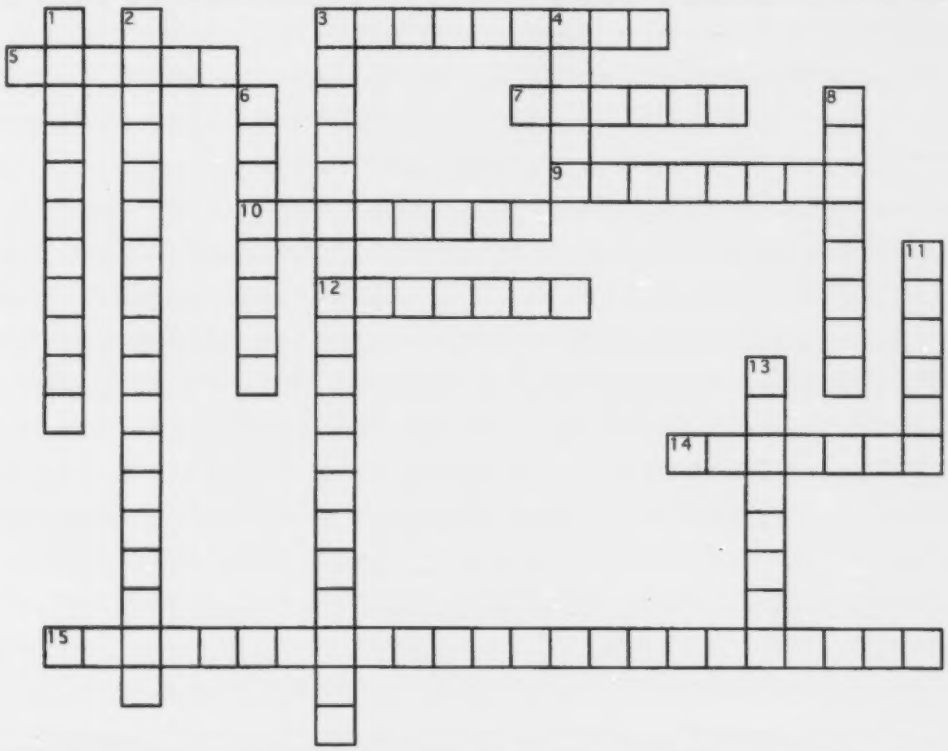
1. The _____ is about 5 inches long and is composed of muscle lined with mucous membrane; it passes air from the nasal cavities to the larynx; it consists of three divisions: the nasopharynx, the oropharynx, and the laryngopharynx
5. A tube of smooth muscle lined with mucous membrane; it is about 4½ inches long and about 1 inch from side to side
8. The middle portion of the pharynx that lies behind the mouth and between the palate and the hyoid bone
11. The notch or depression on the medial surface where the bronchus enters the lung; also called the *hilum*
12. The _____ covers the lung and dips into the fissures between the lobes (2 words)
13. Oriented toward the midline; being or occurring in the middle
14. The indentation in the left lung for the heart; also known as the *cardiac depression* (2 words)
15. The collection of pleural fluid in the pleural space (2 words)

DOWN

2. The U-shaped bone situated at the base of the tongue and supporting the tongue and its muscles (2 words)
3. The upper portion of the pharynx that lies behind the nose and above the palate
4. The lower portion of the pharynx that lies immediately below the hyoid bone and above the larynx
6. _____ is secreted by the serous membrane of the pleura (2 words)
7. The _____ lines the chest wall, covers the diaphragm, and reflects over the structures in the mediastinum (2 words)
9. The translucent, bluish-white cartilage present in the joints and in the respiratory passages (2 words)
10. Related to the mediastinum

Crossword Puzzle 5—Terms from Objectives 17 and 18

Name _____ Date _____



ACROSS

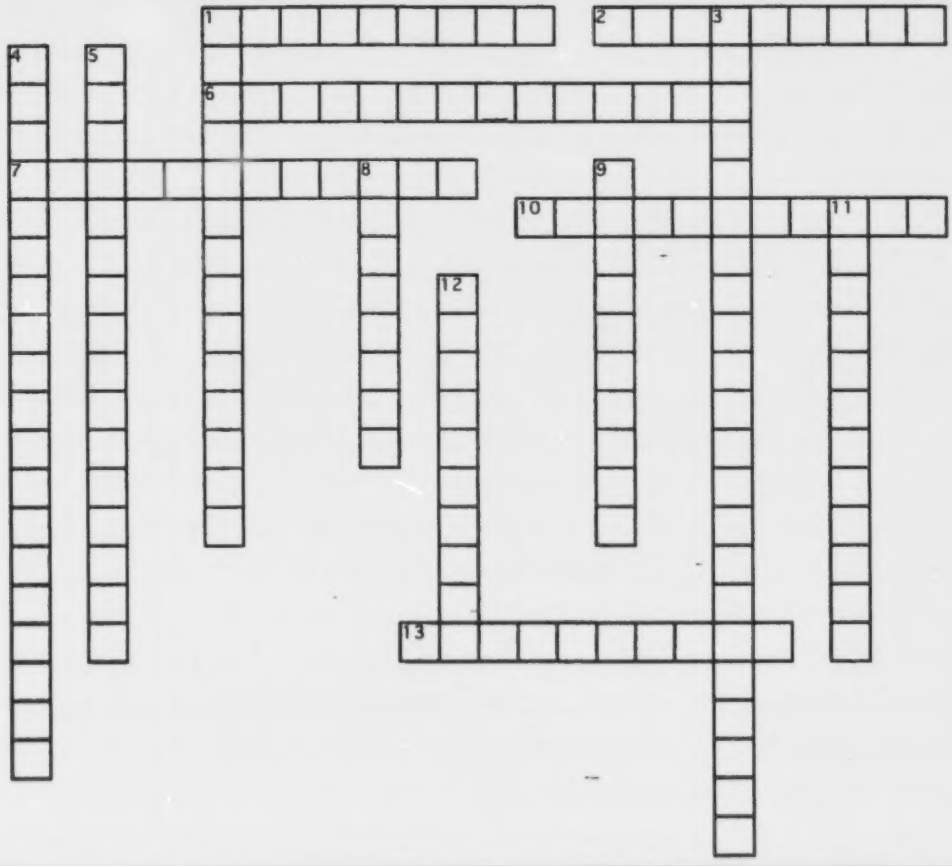
3. The primary muscle of breathing
5. Normal respiration
7. An abnormal condition characterized by a lack of oxygen
9. A condition of increased carbon dioxide and decreased oxygen in the body as a result of diminished respiration
10. _____ intercostals are muscles that elevate the ribs
12. Painful, difficult, and labored respiration
14. The condition resulting from inadequate oxygen reaching the cells
15. An abnormal pattern of respiration characterized by alternating periods of apnea and deep, rapid breathing (3 words)

DOWN

1. An interruption in breathing with oxygen deprivation usually caused by an obstruction in the airways
2. The secondary muscles of breathing; are designated as external and internal (2 words)
3. A shift in the partition of the nasal cavity (3 words)
4. The transient cessation of breathing
6. _____ intercostals are muscles that depress the ribs
8. The condition characterized by bluish-gray discoloration of the skin and mucous membranes as a result of insufficient oxygen
11. A respiratory disorder characterized by constriction of the bronchioles, excessive production of mucus, and difficult breathing
13. An increased rate of respiration, often with deep inspirations

Crossword Puzzle 6—Terms from Objective 18 (cont.)

Name _____ Date _____



ACROSS

1. An acute inflammation of the lungs usually caused by a bacterial infection
2. The deterioration of alveoli and reduced elasticity of the lungs, leading to impairment of normal gas exchange
6. A condition in which fluid accumulates around the vocal cords; also called *edema of the glottis* (2 words)
7. A collection of air or gas in the pleural space causing the lung to collapse
10. An inflammation or infection of the pharynx, usually causing symptoms of a sore throat
13. An acute or chronic inflammation of the bronchial tree, often as a result of infection

DOWN

1. A condition in which fluid accumulates in lung tissues and in the alveoli (2 words)
3. A condition in premature infants whose lungs have not developed enough to allow inflation of the alveoli; also called *respiratory distress syndrome of the newborn* (RDS) (3 words)
4. Any of various conditions in which the mechanics of respiration fail to inflate the alveoli (2 words)
5. An infection of the mucosa of the nose, pharynx, or larynx is called an _____ *infection* (2 words)
8. An inflammation of the mucous membranes of the nasal cavities generally accompanied by swelling of the mucosa and a nasal discharge; also called *coryza*
9. An inflammation or infection of the larynx, usually accompanied by edema of the vocal cords with hoarseness or loss of the voice
11. A chronic, highly contagious infection of the lungs from the bacillus *Mycobacterium tuberculosis*
12. A malignancy seated in the pulmonary tissue, generally affecting lungs damaged by disease, pollutants, or smoking (2 words)

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. RESPIRATORY SYSTEM
4. CELLULAR RESPIRATION
6. BRAINSTEM
9. PHRENIC NERVE

DOWN
2. PULMONARY VENTILATION
3. MEDULLA OBLONGATA
5. PONS
7. MESENCEPHALON
8. CHEMORECEPTOR
10. CAROTID BODY

Crossword Puzzle 2

ACROSS
1. TIDAL VOLUME
5. RESIDUAL AIR
8. EXPIRATORY VOLUME
9. THORAX

DOWN
2. INSPIRATORY VOLUME
3. MINUTE RESPIRATORY VOLUME
4. VITAL CAPACITY
6. PLEURAL CAVITY
7. MEDIASTINUM

Crossword Puzzle 3

ACROSS
5. PLEURA
8. LARYNX
9. CONCHA
11. NOSE
13. INTERCOSTAL MUSCLES
14. DIAPHRAGM

DOWN
1. TRACHEA
2. BRONCHI
3. NASAL SEPTUM
4. NASAL CONCHAE
5. PHARYNX
6. NOSTRILS
7. NASAL SINUSES
10. LUNGS
12. SACCULAR

Crossword Puzzle 4

ACROSS
1. PHARYNX
5. TRACHEA
8. OROPHARYNX
11. HILUS
12. VISCERAL PLEURA
13. MEDIAL
14. CARDIAC NOTCH
15. PLEURAL EFFUSION

DOWN
2. HYOID BONE
3. NASOPHARYNX
4. LARYNGOPHARYNX
6. PLEURAL FLUID
7. PARIETAL PLEURA
9. HYALINE CARTILAGE
10. MEDIASTINAL

Crossword Puzzle 5

ACROSS
3. DIAPHRAGM
5. EUPNEA
7. ANOXIA
9. ASPHYXIA
10. EXTERNAL
12. DYSPNEA
14. HYPOXIA
15. CHEYNE STOKES RESPIRATION

DOWN
1. SUFFOCATION
2. INTERCOSTAL MUSCLES
3. DEVIATED NASAL SEPTUM
4. APNEA
6. INTERNAL
8. CYANOSIS
11. ASTHMA
13. HYPERNEA

Crossword Puzzle 6

ACROSS
1. PNEUMONIA
2. EMPHYSEMA
6. LARYNGEAL EDEMA
7. PNEUMOTHORAX
10. PHARYNGITIS
13. BRONCHITIS

DOWN
1. PULMONARY EDEMA
3. HYALINE MEMBRANE DISEASE
4. RESPIRATORY DISTRESS
5. UPPER RESPIRATORY
8. RHINITIS
9. LARYNGITIS
11. TUBERCULOSIS
12. LUNG CANCER

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 17

1. The external intercostals _____.
   a. elevate the ribs
   b. depress the ribs
   c. elevate the diaphragm
   d. depress the diaphragm

Objective 2

2. The mechanical portion of external respiration is referred to as _____.
   a. *venting*
   b. *contracting*
   c. *breathing*
   d. *expiring*

Objective 15

3. Excess secretion of pleural fluid results in _____.
   a. pneumonia
   b. pleural effusion
   c. pleurisy
   d. apnea

Objective 7

4. The openings in the front of the nose are known as the *nostrils* or the _____.
   a. *nasal septum*
   b. *nasal conchae*
   c. *nasal turbinates*
   d. *anterior nares*

Objective 2

5. The major regulator of respiration is the carbon-dioxide level in the _____.

   a. lungs

   b. blood

   c. brain

   d. heart

Objective 18

6. A condition characterized by an abnormal pattern of respiration resulting in alternating periods of apnea and deep, rapid breathing is called _____.

   a. *Cheyne-Stokes respiration*

   b. *anoxia*

   c. *dyspnea*

   d. *involuntary respiratory cycling*

Objective 5

7. Another term used to describe the windpipe is the _____.

   a. pharynx

   b. larynx

   c. trachea

   d. nares

Objective 13

8. Which of the following is a correct statement about the lungs?

   a. The lungs are the essential organs of digestion.

   b. The lungs are oval-shaped but not large enough to fill the pleural portion of the thoracic cavity.

   c. The lungs are spongy, elastic, and have a specific gravity greater than 1.0.

   d. The two lungs rest side by side and extend from the diaphragm to a point slightly above the clavicles and lie against the ribs at the anterior and posterior.

Objective 3

9. The amount of air that remains in the lungs after the most-forceful expiration is _____.

   a. residual air

   b. vital capacity

   c. tidal volume

   d. minute respiratory volume

Objective 18

10. _____ is a condition of increased carbon dioxide and decreased oxygen in the body as a result of diminished respiration.

    a. Suffocation

    b. Asphyxia

    c. Dyspnea

    d. Hypoxia

Objective 4

11. Which of the following is a correct statement about the thorax?

    a. The area occupied by the lungs is called the *pleural cavity.*

    b. The space between the lungs is called the *thorax.*

    c. The space occupied by the diaphragm is called the *intercostal cavity.*

    d. The area occupied by the heart is called the *mediastinum.*

Objective 18

12. Pneumonia is _____.

    a. an acute inflammation of the lungs usually caused by a bacterial infection

    b. a chronic, highly contagious infection of the lungs from the bacillus *Mycobacterium tuberculosis*

    c. an inflammation of the bronchial tree, often as a result of infection

    d. an inflammation of the mucous membranes of the nasal cavities generally caused by viruses

Objective 2

13. Normal external respiration occurs at a rate of _____ times per minute.

    a. 10 to 15

    b. 14 to 20

    c. 18 to 25

    d. 24 to 30

Objective 5

14. The _____ is the muscular, tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for both the respiratory and digestive tracts.

    a. pharynx

    b. larynx

    c. trachea

    d. nares

Objective 6

15. The structure indicated by the letter "V" in the illustration on the next page is the _____.

    a. nose
    b. pharynx
    c. larynx
    d. trachea

Objective 6

16. The structure indicated by the letter "W" in the illustration on the next page is the _____.

    a. trachea
    b. ribs
    c. left bronchus
    d. left lung

Objective 6

17. The structure indicated by the letter "X" in the illustration on the next page is the _____.

    a. right bronchus
    b. right lung
    c. mediastinum
    d. diaphragm

Objective 6

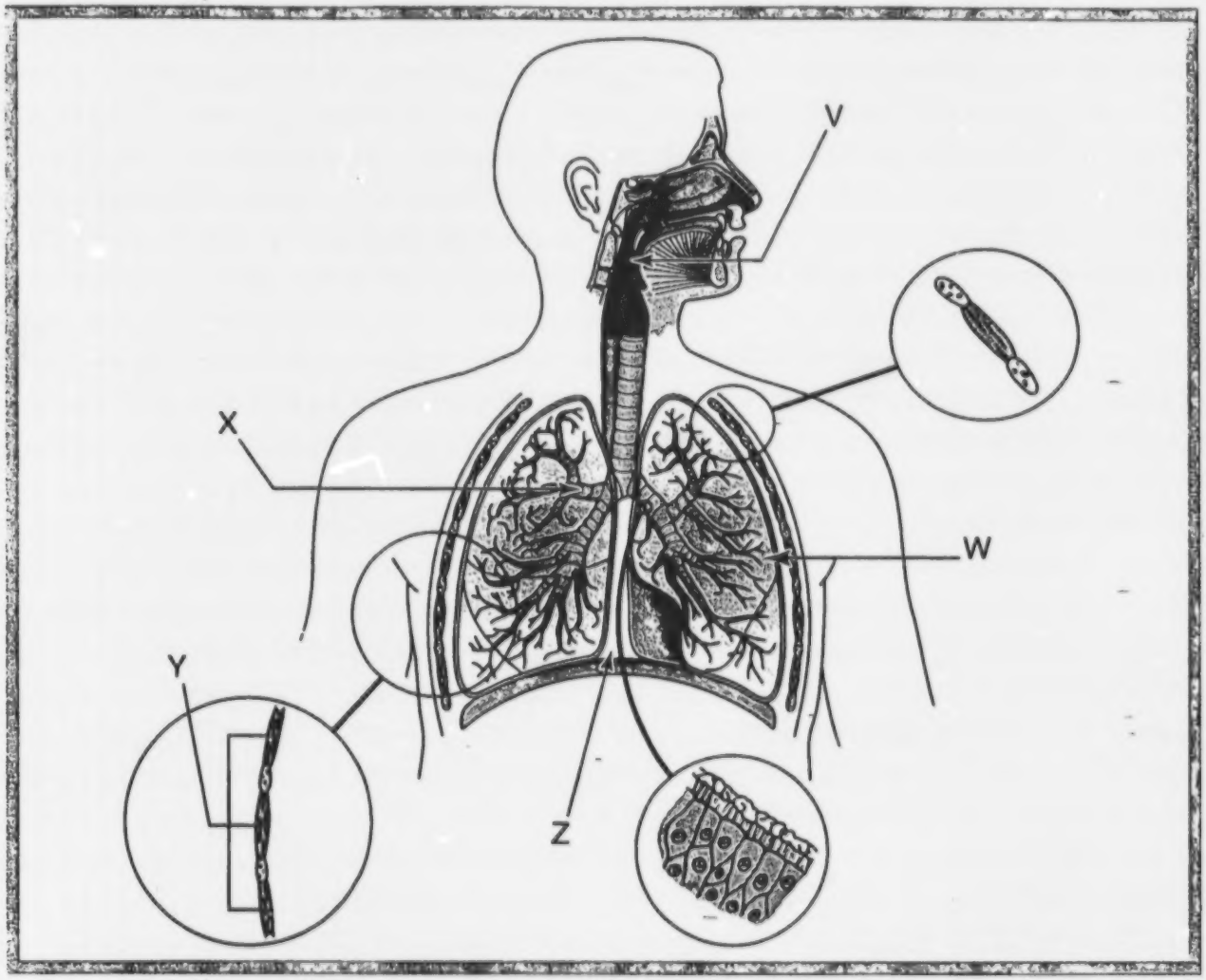
18. The structures indicated by the letter "Y" in the illustration on the next page are the _____.

    a. bronchial cilia
    b. cells of a bronchus
    c. intercostal muscles
    d. ribs

Objective 6

19. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

    a. mucus
    b. bronchial cilia
    c. cell of a bronchus
    d. mediastinum



Objective 2

20. Which of the following is NOT a true statement with regard to the nervous system's control of breathing?

a. Breathing is controlled by the medulla oblongata and the pons of the brainstem.

b. The brain sends impulses down the spinal cord to the phrenic nerve and out to the diaphragm.

c. If the brainstem is severed in the cervical area or if the phrenic nerve is severed, respiration will be controlled entirely by the medulla.

d. The medulla is governed by variations in the chemistry of the blood that are detected by chemoreceptors in the carotid body and the aortic arch.

Objective 11

21. Each bronchus enters the lung at the notch or depression on the medial surface called the _____.

    a. *hilus*

    b. *alveolus*

    c. *medial fossa*

    d. *medial meatus*

Objective 7

22. Which of the following statements is NOT true concerning the nose?

    a. It serves as a passageway for air going to the lungs.

    b. It warms, moistens, and filters the air.

    c. Its mucous membranes have few blood vessels.

    d. Its nasal cavities are separated by a septum.

Objective 13

23. The left lung has an indentation for the heart called the _____.

    a. *hilus*

    b. *cardiac notch*

    c. *bronchial indentation*

    d. *respiratory cleft*

Objective 8

24. The three divisions of the pharynx are the _____.

    a. oropharynx, monopharynx, and the laryngopharynx

    b. nasopharynx, the oropharynx, and the laryngopharynx

    c. laryngopharynx, the tracheopharynx, and nasopharynx

    d. monopharynx, the tracheopharynx, and the linguopharynx

Objective 10

25. Which of the following is a true statement with regard to the rings that strengthen the trachea?

    a. There are 12 to 15 C-shaped rings.

    b. The rings are composed of hyaline cartilage.

    c. The open portion of the C is anterior.

    d. The rings are formless at birth but define their shape and harden as a person matures.

Objective 8

26. The _____ is the upper portion of the pharynx that lies behind the nose and above the palate.

a. monopharynx

b. oropharynx

c. tracheopharynx

d. nasopharynx

Objective 11

27. The _____ bronchus is shorter and more vertical than the other bronchus.

a. left

b. right

c. anterior

d. posterior

Objective 9

28. The _____ is the lowest of the cartilage structures of the larynx and has the appearance of a signet ring.

a. epiglottis

b. cricoid cartilage

c. thyroid cartilage

d. hyaline cartilage

Objective 18

29. _____ is an increased rate of respiration, often with deep inspirations.

a. Apnea

b. Dypsnea

c. Hypernea

d. Anoxia

Objective 13

30. The lung root attaches to the mediastinum and is composed of _____.

a. the primary bronchi and lymph vessels and nodes

b. the pulmonary arteries and veins and nerves

c. the bronchial arteries and veins

d. all of the above

Objective 10

31. Which of the following statements is NOT true concerning the trachea?

    a. The trachea is about 4½ inches long.

    b. The trachea is about 2 inches from side to side.

    c. The trachea is a tube of smooth muscle.

    d. The trachea is lined with mucous membrane.

Objective 13

32. The medial surface of each lung is concave to allow room for the _____.

    a. mediastinal structures and the heart

    b. bronchi and the heart

    c. mediastinal structures and bronchi

    d. bronchi and the diaphragm

Objective 11

33. Which of the following is NOT a correct statement with regard to the structures of the bronchi?

    a. The structure of the bronchi resembles the trachea as the walls contain cartilage rings and ciliated mucous lining.

    b. Each primary bronchus enters the lung on its respective side and immediately subdivides into smaller branches called *secondary bronchi.*

    c. Secondary bronchi continue to branch, forming small bronchioles that have cartilage rings thicker than those in the primary bronchus.

    d. The bronchioles subdivide into smaller and smaller tubes, eventually ending in microscopic branches that divide into alveolar ducts, ending in several alveolar sacs that consist of numerous alveoli.

Objective 9

34. The _____ is the largest laryngeal cartilage and is commonly called the *Adam's apple.*

    a. epiglottis

    b. cricoid cartilage

    c. thyroid cartilage

    d. glottis

Objective 7

35. Which of the following statements regarding the nasal cavities is NOT true?

a. The nose consists of two nasal cavities.

b. The nasal cavities lie between the roof of the mouth and the cranium.

c. The nasal cavities are constructed of bone covered by ciliated mucous membranes.

d. The mucous membranes of the nose are very vascular to protect the nasal cavities from warmth and moisture.

Objective 3

36. Inspiratory volume is the amount of air _____.

a. involved in one respiration cycle

b. inhaled and exhaled during a one-minute period

c. that can be taken in with the deepest possible inhalation beyond tidal volume

d. that can be expelled with the most forceful exhalation possible beyond tidal volume

Objective 13

37. Which of the following is NOT a correct statement about the lungs?

a. The apex of a lung is the pointed upper margin that extends slightly above the clavicle.

b. The base of a lung is the broad, inferior surface that lies on the diaphragm.

c. The left lung is slightly larger, heavier, and shorter by about one inch than the right lung.

d. The right lung is divided into three lobes.

Objective 9

38. The larynx consists of nine pieces of cartilage that are connected by _____ and are moved by various muscles.

a. ligaments

b. tendons

c. connective tissue

d. esophageal muscle

Objective 14

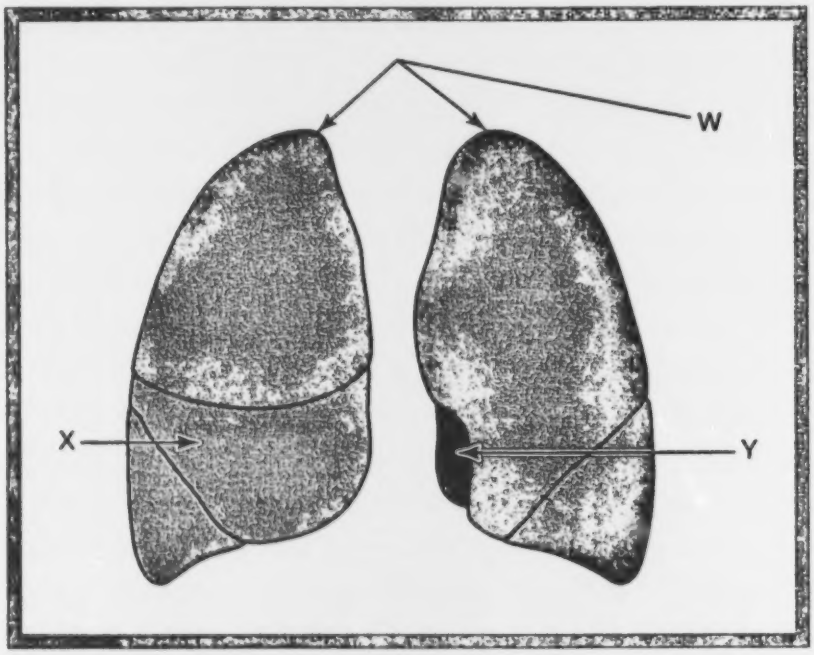
39. The structure indicated by the letter "W" in the illustration below is the _____ of each lung.

a. base

b. cardiac notch

c. left upper lobe

d. apex



Objective 14

40. The structure indicated by the letter "X" in the illustration above is the _____.

a. right lower lobe

b. right middle lobe

c. right upper lobe

d. apex

Objective 14

41. The structure indicated by the letter "Y" in the illustration above is the _____.

a. apex

b. base

c. cardiac notch

d. left lower lobe

Objective 2

42. High concentrations of carbon dioxide in the blood _____ the rate of respiration, while decreased concentrations of carbon dioxide will _____ the rate of respiration.

a. increase; slow

b. increase; speed

c. decrease; speed

d. decrease; slow

Objective 13

43. When filled to capacity, a lung can hold approximately 4500 cubic centimeters of air, though only _____ cubic centimeters are inhaled and exhaled in a normal breath.

a. 500

b. 1000

c. 2000

d. 2500

Objective 15

44. Which of the following statements is NOT true concerning the pleura?

a. The visceral pleura covers the lung.

b. The parietal pleura lines the chest wall.

c. The parietal pleura and the visceral pleura are separated by fibrous tissue.

d. Parietal pleura reflects over the structures in the mediastinum.

Objective 2

45. There are two stages to breathing: _____.

a. inspiration and respiration

b. inspiration and inhalation

c. exhalation and expiration

d. inhalation and exhalation

Objectives 5 & 17

46. Which of the following is a correct statement about the diaphragm?

a. The diaphragm is a dome-shaped muscle.

b. The diaphragm is the primary organ of breathing.

c. On expiration, the diaphragm contracts, flattens, and moves downward to enlarge the thoracic cavity.

d. On inspiration, the diaphragm relaxes and moves upward to decrease the size of the thoracic cavity.

Objective 16

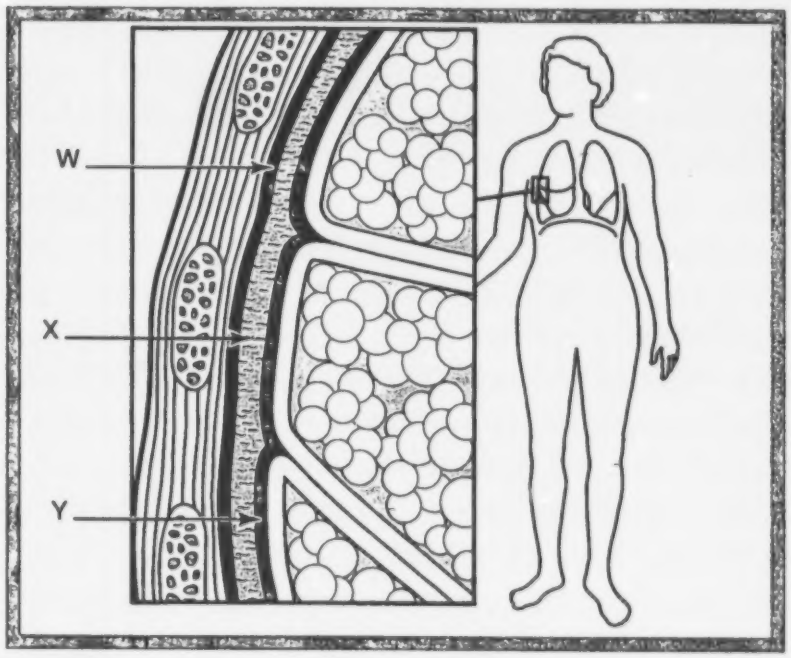
47. The structure indicated by the letter "W" in the illustration below is the _____ of the pleura.

a. parietal layer

b. pleural fluid

c. visceral layer

d. intercostal layer



Objective 16

48. The structure indicated by the letter "X" in the illustration above is the _____ of the pleura.

a. parietal layer

b. pleural fluid

c. visceral layer

d. intercostal layer

Objective 16

49. The structure indicated by the letter "Y" in the illustration above is the _____ of the pleura.

a. parietal layer

b. pleural layer

c. visceral layer

d. intercostal layer

Objective 1

50. Which of the following phrases is NOT a function of the respiratory system.

a. inhaling and exhaling air through the lungs; breathing

b. ensuring that blood circulates through the body so that oxygen can be carried to the cells

c. performing external respiration

d. performing internal respiration

Objective 8

51. Which is the lower portion of the pharynx that lies immediately below the hyoid bone and above the larynx?

a. laryngopharynx

b. nasopharynx

c. tracheopharynx

d. linguopharynx

Objective 18

52. _____ is a condition resulting from inadequate oxygen reaching the cells.

a. Anoxia

b. Hypoxia

c. Apnea

d. Hypernea

Objective 5

53. The large air passages in the lungs through which pass inspired air and exhaled waste gases are the _____.

a. bronchi

b. intercostals

c. pleura

d. nares

Objective 13

54. At birth, a person's lungs are pink, but with age they become a mottled-gray color due to _____.

a. reduced circulation

b. the loss of pigment with aging

c. increased muscle density with use

d. the inhalation of dust, pollution, and smoke

Objective 12

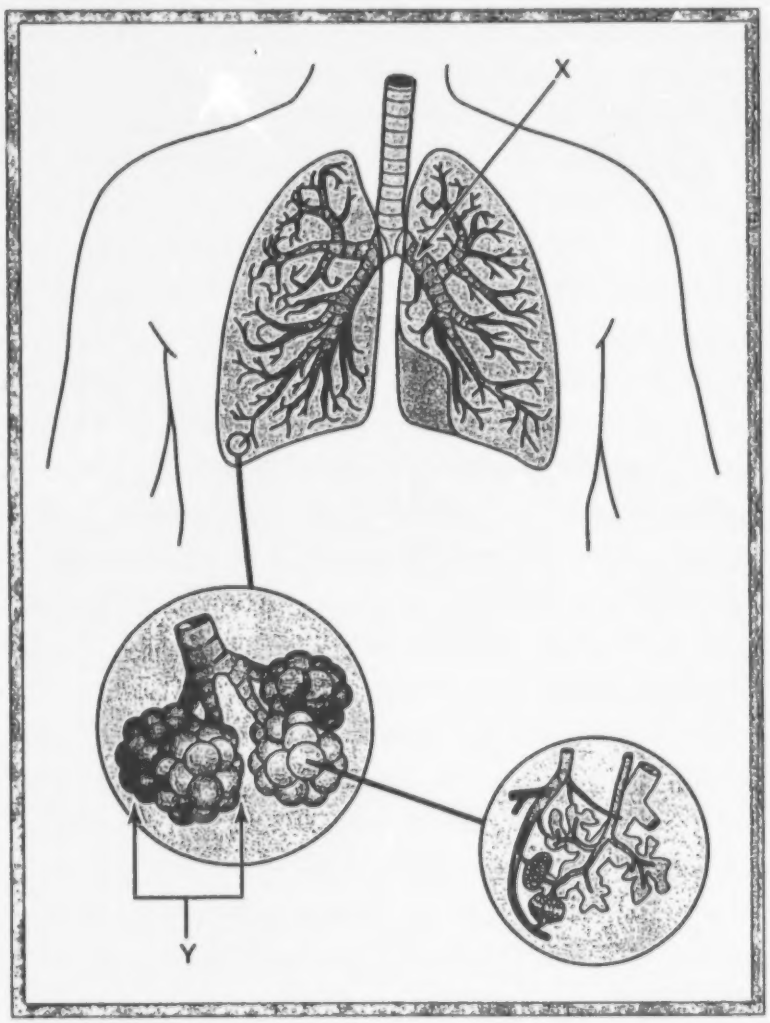
55. The structure indicated by the letter "X" in the illustration below is the _____.

a. pulmonary artery

b. left bronchus

c. bronchiole

d. right bronchus



Objective 12

56. The structure indicated by the letter "Y" in the illustration above is the _____.

a. terminal bronchiole

b. right bronchus

c. alveolar sac

d. left bronchus

Objective 18

57. Cyanosis is _____.

a. any of various conditions in which the mechanics of respiration fail to inflate the alveoli

b. a condition in which fluid accumulates in the alveoli

c. a condition in premature infants whose lungs have not developed enough to allow inflation of the alveoli

d. a condition characterized by bluish-gray discoloration of the skin and mucous membranes as a result of insufficient oxygen

Objective 18

58. A respiratory disorder characterized by constriction of the bronchioles, excessive production of mucus, and difficult breathing is _____.

a. emphysema

b. asthma

c. laryngeal edema

d. pulmonary edema

Objective 10

59. The _____ is the translucent, bluish-white cartilage present in the joints and in the respiratory passages.

a. hyaline cartilage

b. thyroid cartilage

c. cricoid cartilage

d. epiglottis

Objective 18

60. _____ is a condition in which fluid accumulates in lung tissues and in the alveoli.

a. Pneumothorax

b. Emphysema

c. Pulmonary edema

d. Laryngeal edema

Answers to Module Review

1. a	13. b	25. b	37. c	49. c
2. c	14. a	26. d	38. a	50. b
3. b	15. b	27. b	39. d	51. a
4. d	16. d	28. b	40. b	52. b
5. b	17. a	29. c	41. c	53. a
6. a	18. c	30. d	42. a	54. d
7. c	19. d	31. b	43. a	55. b
8. d	20. c	32. a	44. c	56. c
9. a	21. a	33. c	45. d	57. d
10. b	22. c	34. c	46. a	58. b
11. a	23. b	35. d	47. a	59. a
12. a	24. b	36. c	48. b	60. c

MODULE SET II:
Major Body Systems

Module 12: Digestive System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Digestive System	9
2—Major Organs and Structures of the Digestive System	11
3—Major Structures of the Mouth	13
4—Major Structures of a Tooth	15
5—Types of Teeth as Classified by Location	17
6—Major Structures of the Stomach	19
7—Major Structures of the Large Intestine	21
8—Major Structures of the Liver, Pancreas, and Gallbladder	23
Written Test	25
Answers to Written Test	47
Answers to Assignment Sheet	55
Crossword Puzzles	
1—Terms from Objectives 1 and 2	57
2—Terms from Objectives 3 Through 6	59
3—Terms from Objective 8	61
4—Terms from Objectives 10 Through 12	63
5—Terms from Objectives 14 Through 16	65
6—Terms from Objectives 18 Through 20	67
7—Terms from Objectives 21 and 22	69
8—Terms from Objectives 24 Through 27	71
9—Terms from Objective 30	73
10—Terms from Objective 30 (cont.)	75
11—Terms from Objective 30 (cont.)	77
12—Terms from Objective 30 (cont.)	79
Answers to Crossword Puzzles	81
Module Review	85
Answers to Module Review	113

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activity Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 6 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 7 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module has more objectives than many of the other modules in this course. You may choose to break the module into two or more parts. One model for splitting the module is to cover the primary organs of the alimentary tract and then the accessory organs. Another approach is to discuss the digestive system from the mouth to some other point, such as the stomach, and then to continue the presentation with another portion of the system. The material, including the objectives and the written test and module review, can be divided to support any of these approaches.

- Use crossword puzzles 1 through 12 to help reinforce the terms in the associated objectives.
- Use the following strategies to supplement your discussion of Objective 1 and Objective 2 and to introduce the module.
  - Introduce the module by serving the class a snack. You may want to include a variety of food groups, such as cheese or peanut butter and crackers, vegetables, fruit, and sweets. Ask the students the purpose of eating and lead them into thinking about how food eventually gets converted into a form of energy that the cells can use—especially when foods come in such a variety of chemical and physical types.
  - Review the module objectives to provide an overview of the digestive system and relate the objectives to your introduction to the unit. Guide the students toward the realization that the digestive system involves more organs than any other system that they have studied. Lead them in speculating why this might be the case. Explain the format for your presentation of the material.
  - Discuss the functions of the digestive system. Help the students to understand the concepts of nutrients and calories. As appropriate to your class, review human nutrient needs and sources of those nutrients. Have the students discuss any supplements that they may be taking and the reasons for taking them. Invite a nutritionist to talk to your class about nutritional requirements. Have the students track their nutrient intake and/or calorie intake during the period that this module is presented. Have them evaluate their caloric requirements for a typical day.
- Use the following strategies to supplement your discussion of Objective 3 through Objective 7.
  - Use illustrations and models to discuss the anatomy of the alimentary tract.
  - Discuss your preferred terminology, such as alimentary tube or GI tract, including upper and lower GI tract.

- — Give an overview of the function of each organ and how that function contributes to the digestive process.

- — Use illustrations and models to discuss the accessory glands—the liver, pancreas, and gallbladder.

- — Give an overview of the function of each gland and how that function contributes to the digestive process.

- Use the following strategies to supplement your discussion of Objective 8 through Objective 13.

  - — Provide students with X rays of the mouth and discuss its structure.

  - — Invite a dentist or oral surgeon to discuss the structure of the mouth and related surgical procedures.

  - — Display teeth of various types, including teeth with cavities. Have the students discuss how the variations in the shapes of teeth help these accessories to assist in the digestive process. Distinguish between physical and chemical digestion. Lead the students to understanding how digestion is assisted even before we ingest the food through cooking, cutting, etc. Display skulls of various animals, including both herbivores and carnivores, those with specialized teeth. Discuss the importance of good dental hygiene.

  - — Use illustrations and models to discuss the salivary glands. Discuss the phrase, "the food's so good it makes your mouth water." Have the students eat crackers or some other food that may be difficult to swallow. Point out that they drink with those foods and ask them why, leading to the idea of lubricating the food they swallow. Discuss the role of salivary enzymes.

- To supplement your discussion of Objective 14 and Objective 15, remind the students of their study of the respiratory system and the parts of the nasopharyngeal structures. Relate these concepts to the pharynx and its role in the digestive process. Have students observe each other's throats and uvulae. Discuss the importance of being able to separate the trachea and esophagus. Ask the students how they can swallow while lying down or while hanging upside down or how astronauts in a weightless condition can swallow. Discuss the esophagus and peristaltic motion. Demonstrate the Heimlich maneuver.

- To supplement your discussion of Objective 16 through Objective 18, use artwork, models, and animal stomachs to illustrate the structure and anatomy of the stomach. Point out the sphincters at each end of the stomach and discuss their roles. Provide photographs or specimens of ulcerated stomachs. Have the students speculate on how the shape of the stomach assists with the digestive process. Provide X rays of foreign objects in stomachs. Use illustrations and models to discuss the blood and nervous supply to the stomach.

- Use the following strategies to supplement your discussion of Objective 20 through Objective 24.

  - — Using illustrations, models, and animal intestines, discuss the structure and anatomy of the small and large intestines. Compare and contrast the structures of the linings of the two types of intestine. Relate these differences to the role of each intestine.

- — Ensure that students understand the flexures of the large intestines.
- — Display removed appendices and have a surgeon discuss the procedure.
- — Discuss the blood supply to the intestines and how this relates to their function.

- Use the following strategies to supplement your discussion of Objective 25 through Objective 29, concerning the liver, the pancreas, and the gallbladder.
  - — Continue your discussion of the circulatory system relative to the intestines by focusing on the circulatory system and the liver. Ask the class why it would be important to detoxify blood coming from the stomach and small intestine. Discuss other roles of the liver. Ask the class why fish and animal livers are considered to be good sources of iron and vitamins. Discuss the storage of vitamins and minerals in the liver. Discuss cholesterol and the role of the liver. Discuss blood volume, clotting, anticoagulation, the disposal of old red blood cells, and blood volume as related to the functions of the liver, as well as the analysis of blood by the liver for glucose level and other factors.
  - — Using illustrations, models, and animal livers, discuss the structure of the liver, including lobes, ligaments, and the gallbladder. Point out the ducts of the liver and their relationship to other organs. Discuss the blood supply to the liver.
  - — Use illustrations, models, and animal pancreases to discuss the structure and functioning of the pancreas. Provide specimen slides or stained specimens to allow observation of the islets of Langerhans. Relate the ducts of the pancreas to the liver and other organs. Invite a diabetic to speak to the class or a physician who can tell about insulin pumps and other techniques for dealing with insulin deficiencies.
  - — Display a sample of bile and discuss its purposes.
- Discuss the common disorders and abnormalities associated with the digestive system, as presented in Objective 30. You may choose to do this at the conclusion of the module study or you may prefer to discuss illnesses and disorders along with the presentation of the material about the organs with which the disease or disorder is associated. Invite specialists or patients afflicted with conditions to discuss the diseases and disorders.
- Summarize the module by reviewing sources of nutrients and how they are handled by the digestive system.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.

- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites offer information about the digestive system. Other modules provide links for information about other body systems.

- http://www.innerbody.com/htm/body.html

  This site provides an interactive illustration of the digestive system.

- http://www.jeffersonhospital.org/show.asp?durki=5542

  The Jefferson University Hospital program provides good overview information, including links to other pages on the same site that deal with digestive disorders.

- http://www.msms.doe.k12.ms.us/biology/anatomy/digestive/digestive_frame.htm.

  This site provides good illustrations that address the digestive system organ by organ.

- http://www.niddk.nih.gov/health/digest/digest.htm

  This is the home page for the National Institute for Disease of Digestion and Kidneys. The site provides a good deal of information about digestive disease, with links to individual diseases.

- http://www.mayohealth.org/mayo/9811/htm/digestion_1.htm

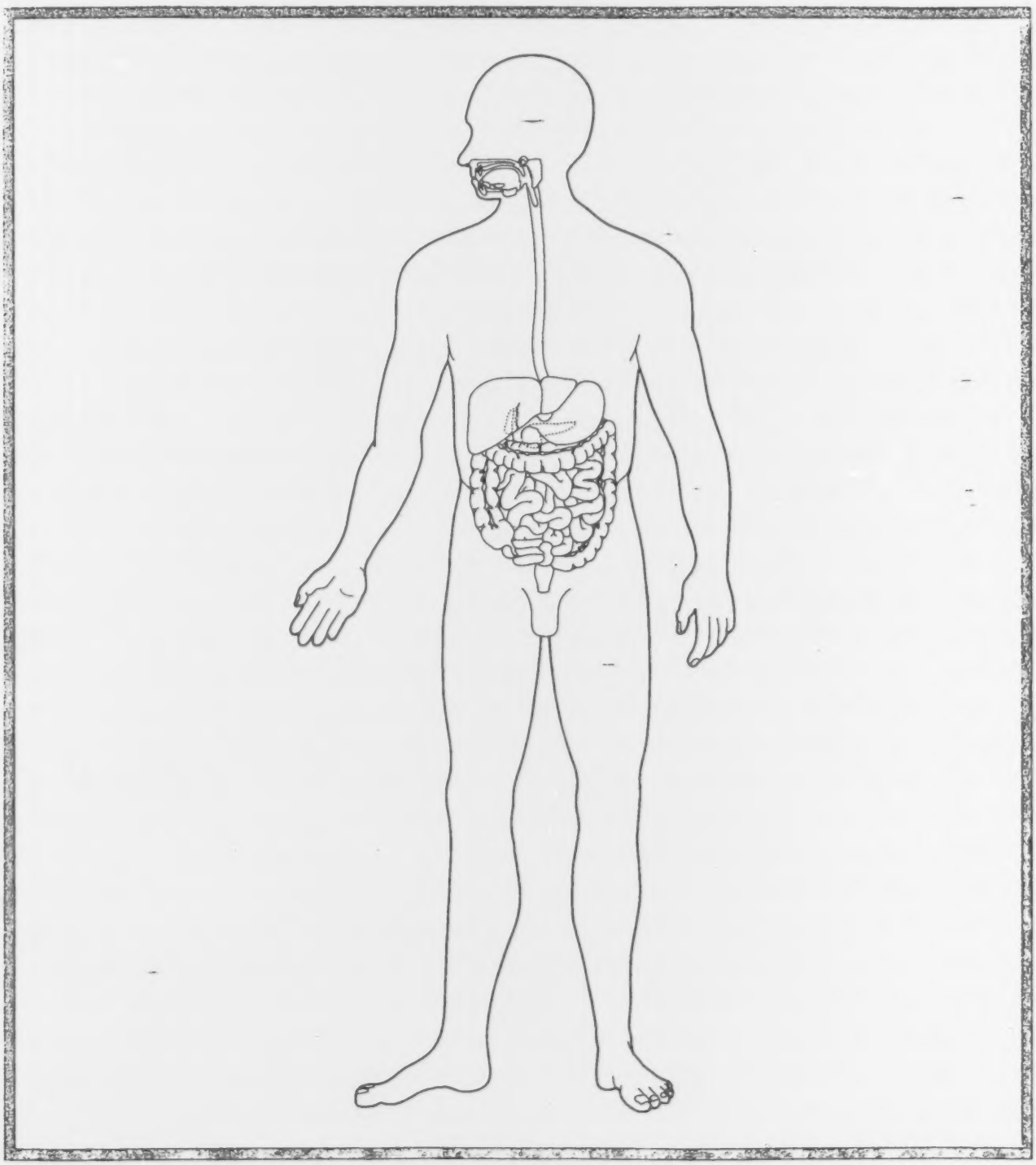
  This site includes numerous interactive illustrations with explanations.

- http://www.accessexcellence.org/AB/GG/enzyme.html

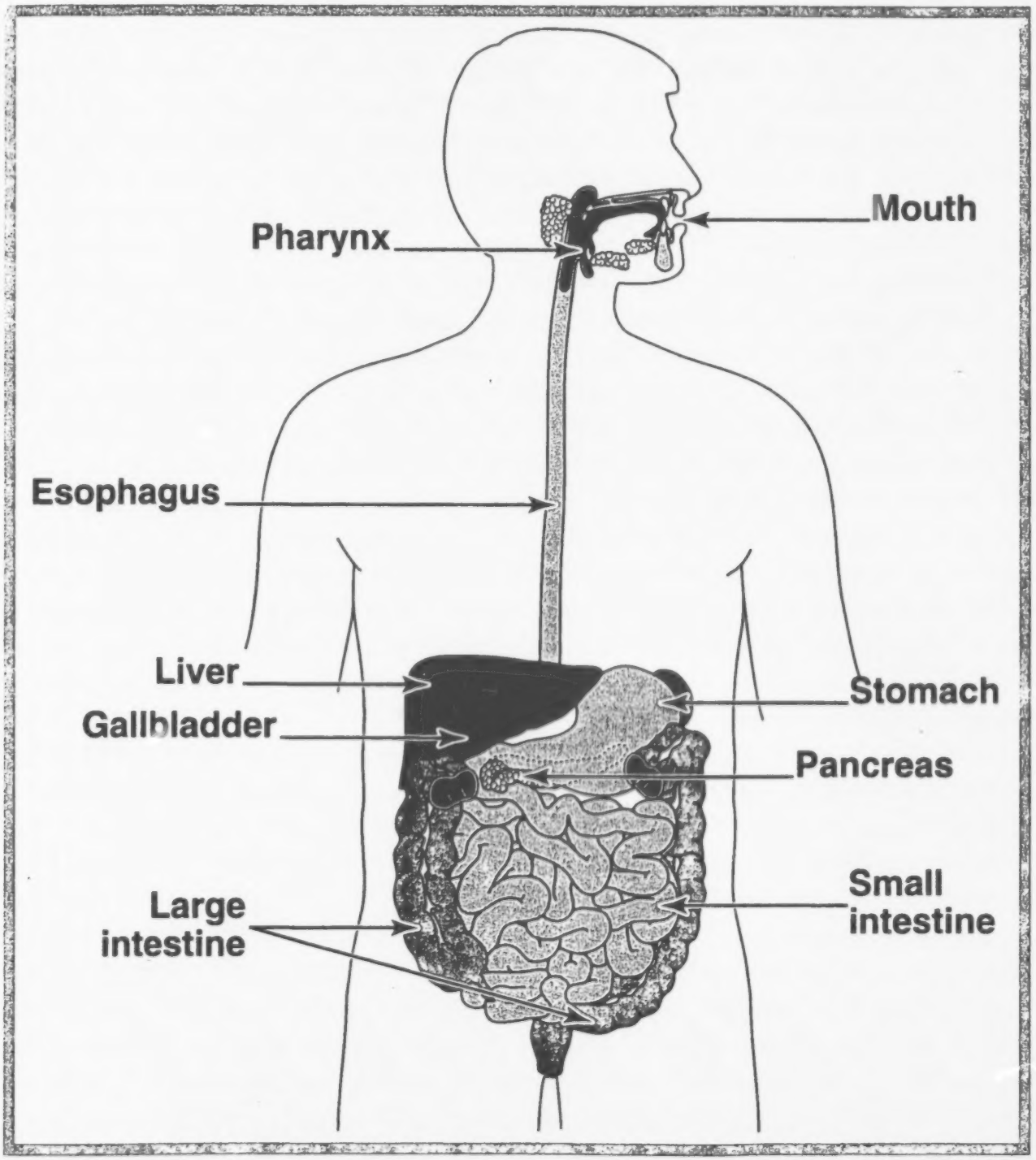
  This site focuses on enzymes and their role in digestion.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

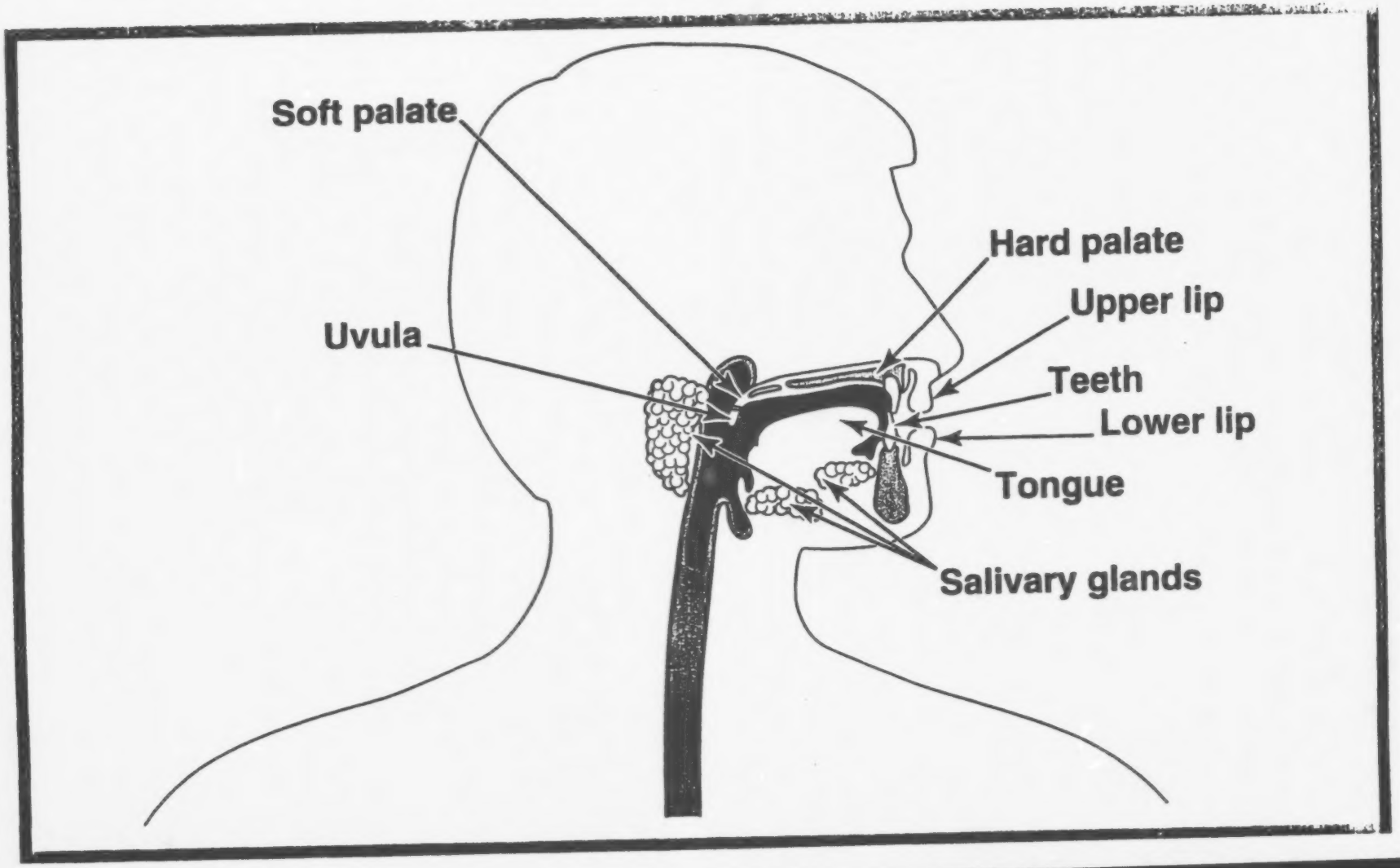
Digestive System



Major Organs and Structures of the Digestive System



Major Structures of the Mouth



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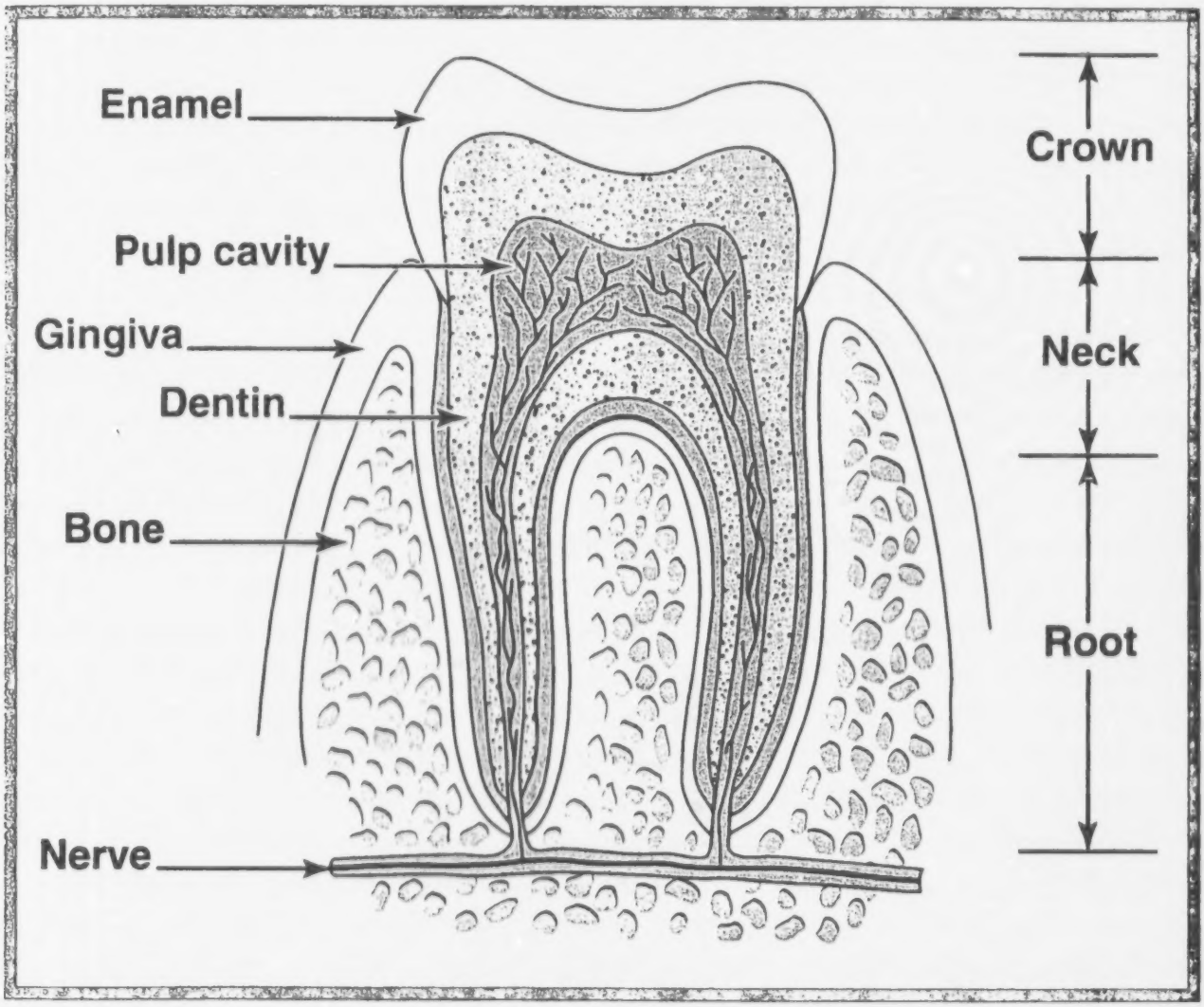
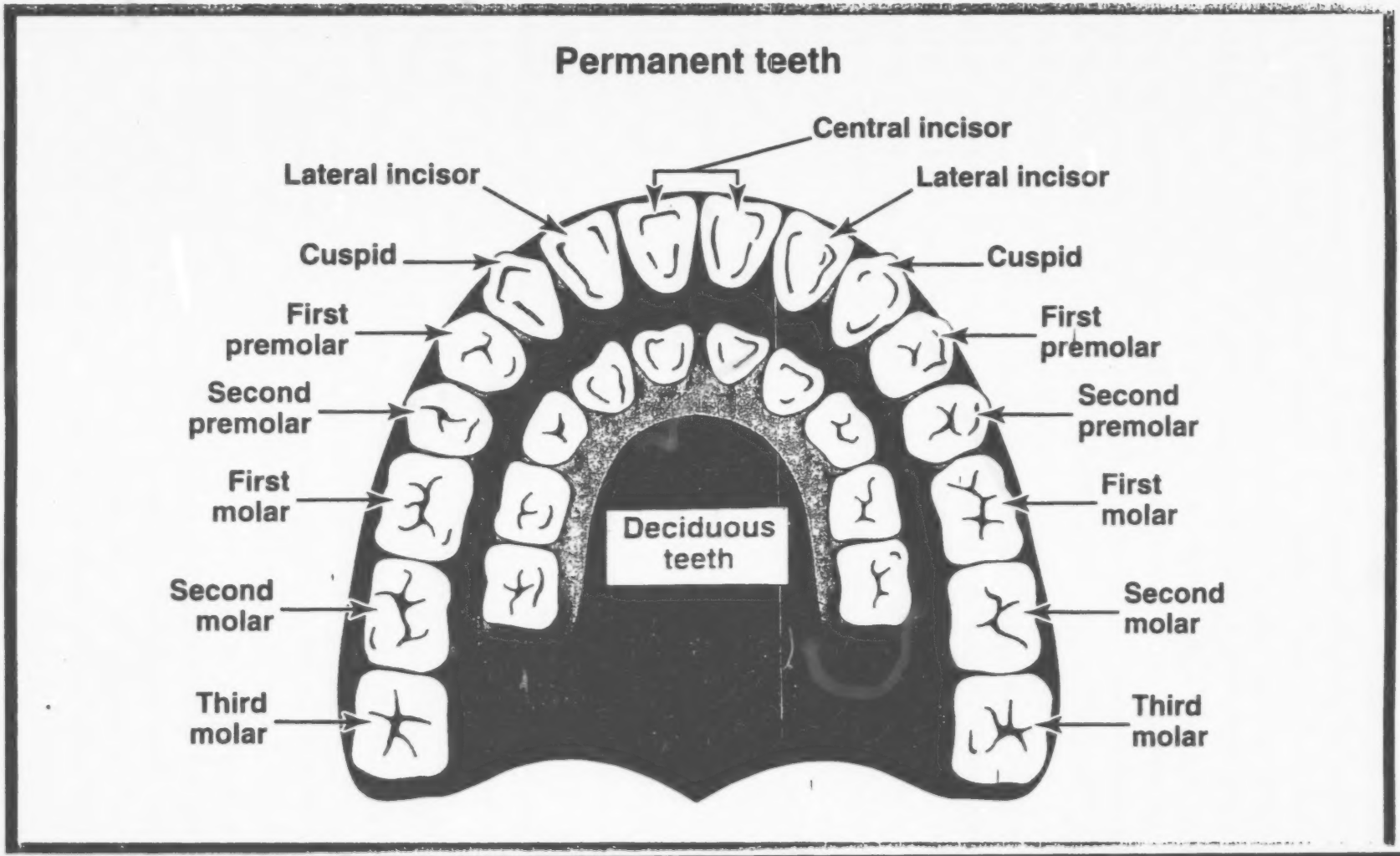
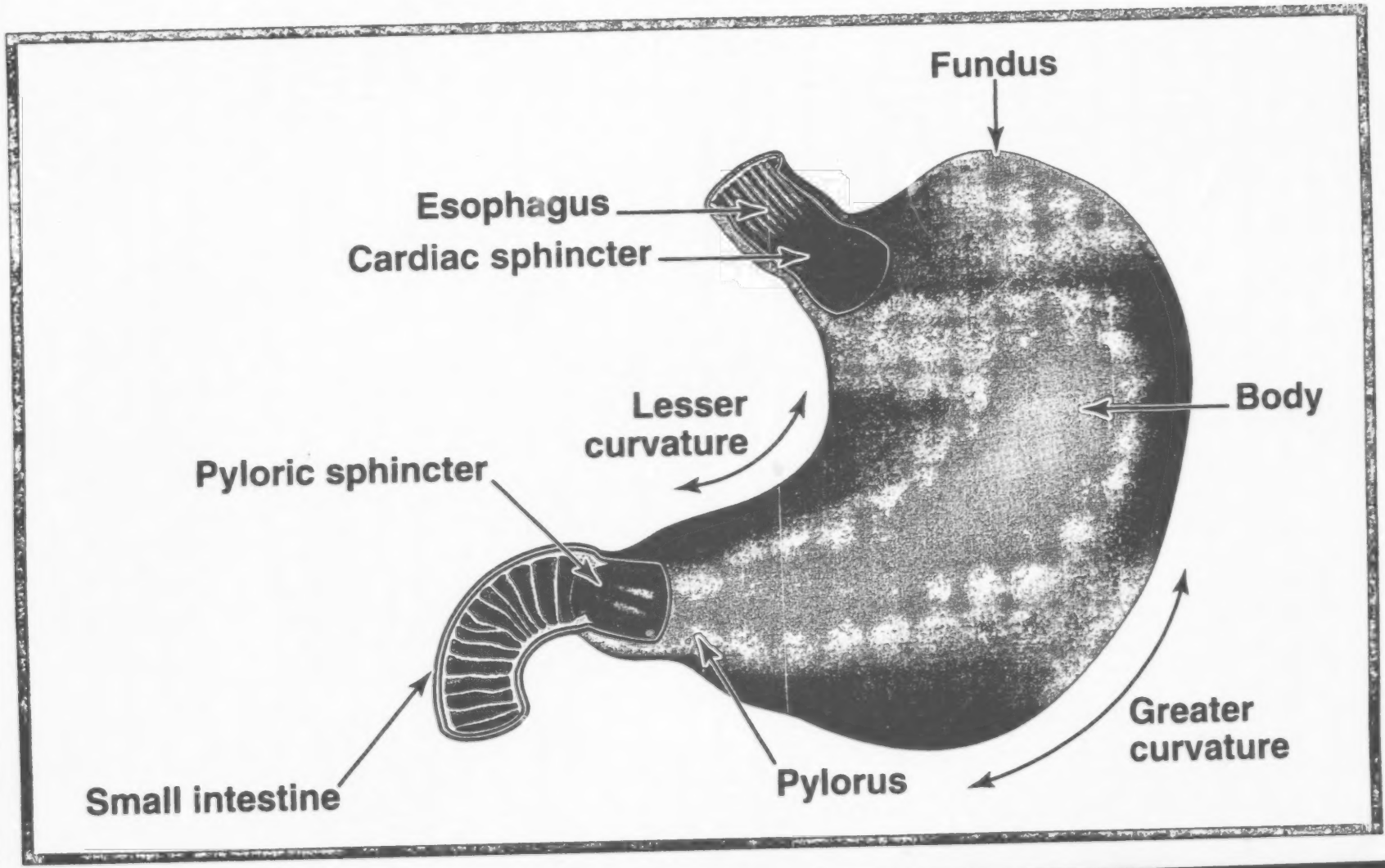
Major Structures of a Tooth



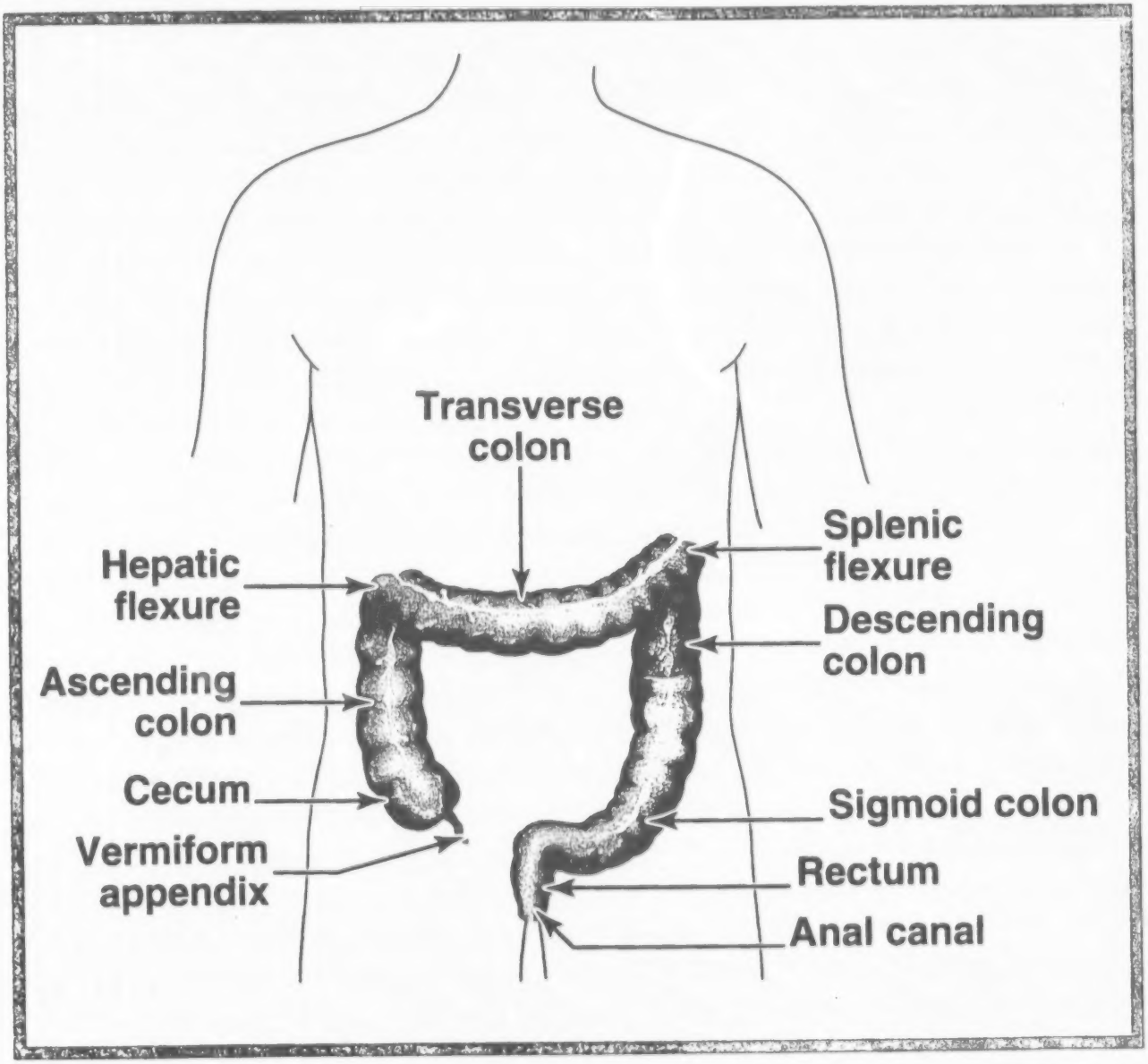
Types of Teeth as Classified by Location and Function



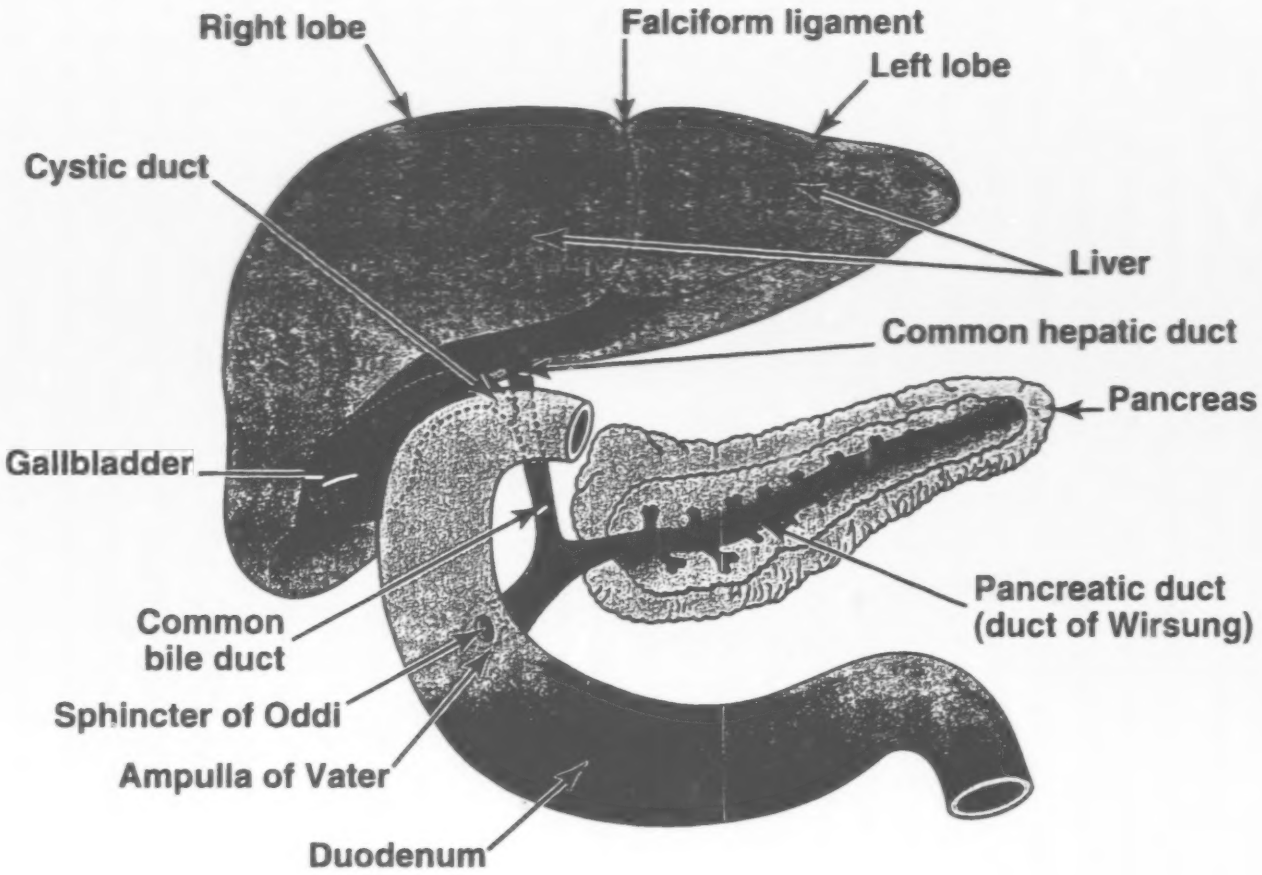
Major Structures of the Stomach



Major Structures of the Large Intestine



Major Structures of the Liver, Pancreas, and Gallbladder



Written Test

Name _____

Date _____ Score _____

OBJECTIVE 1 Define the term *digestive system*. Write your answer on the blank lines provided beside the term below.

Digestive system _____

_____

OBJECTIVE 2 State the functions of the digestive system. Write your answers on the blank lines provided below.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

OBJECTIVE 3 Define the term *alimentary tract*. Write your answer on the blank lines provided beside the term below.

Alimentary tract _____

_____

OBJECTIVE 4 Define the organs and structures of the alimentary tract. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Mouth _____

_____

b. Pharynx _____

_____

c. Esophagus _____

_____

d. Stomach _____

_____

e. Small intestine _____

_____

f. Large intestine _____

_____

Objective 5 Define the term *accessory glands*. Write your answer on the blank lines provided beside the term below.

Accessory glands _____

_____

_____

_____

Objective 6 Define the accessory glands of the digestive system. Write your answers on the blank lines provided beside each of the terms below.

a. Liver _____

_____

_____

b. Pancreas _____

_____

_____

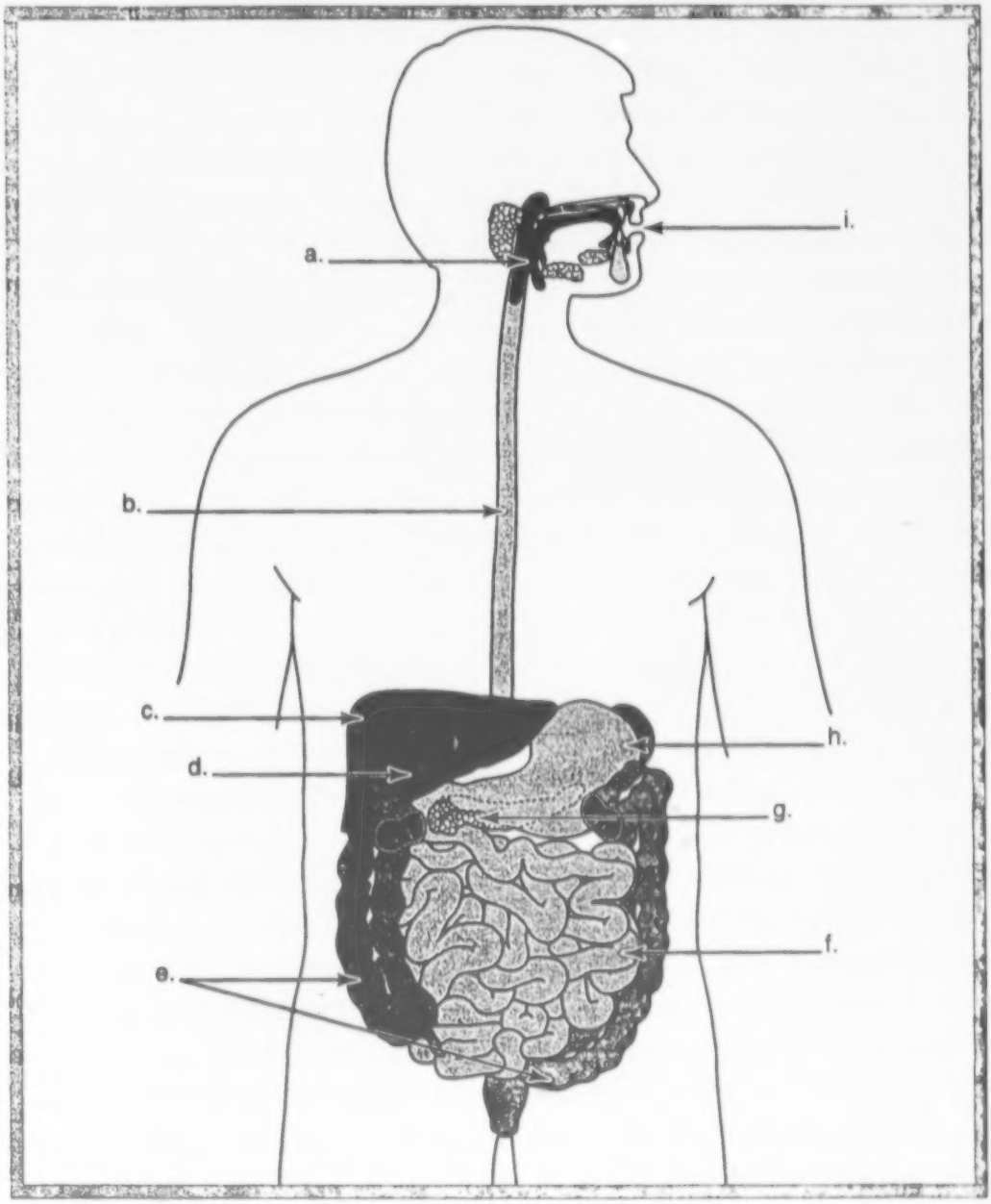
c. Gallbladder _____

_____

_____

OBJECTIVE 7

Label the major organs and structures of the digestive system. Write your answers on the blank lines provided below the following illustration.



a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

i. _____

OBJECTIVE 8

Complete statements that describe the characteristics and structures of the mouth. Write your answers on the blank lines provided in the statements below and on the next page.

a. The mouth is the oral cavity enclosed by the _____ and _____.

b. The major structures of the mouth (oral cavity) are the _____, the _____, the _____, the _____, and the _____.

c. The _____ forms most of the floor of the mouth and assists in mastication and deglutition of food.

d. The _____ and the _____ are the two structures that form the roof of the mouth.

e. The _____ is the structure composed of bone that forms the anterior part of the roof of the mouth; the _____ is the structure that is composed of mucous membrane, muscular fibers, and mucous glands suspended from the posterior border of the hard palate.

f. When the _____ rises in swallowing, it separates the nasal cavity and the nasopharynx from the posterior part of the mouth (oral cavity) and the oral portion of the pharynx.

g. The _____ is the conical structure that hangs from the posterior border of the soft palate.

h. The _____ are the hard, bony structures on the bones of the mouth that mechanically break down food into smaller pieces during mastication.

i. The mouth (oral cavity) contains salivary glands that secrete _____; _____ contains enzymes that begin breaking down food chemically.

j. There are three pair of salivary glands: the _____, the _____, and the _____.

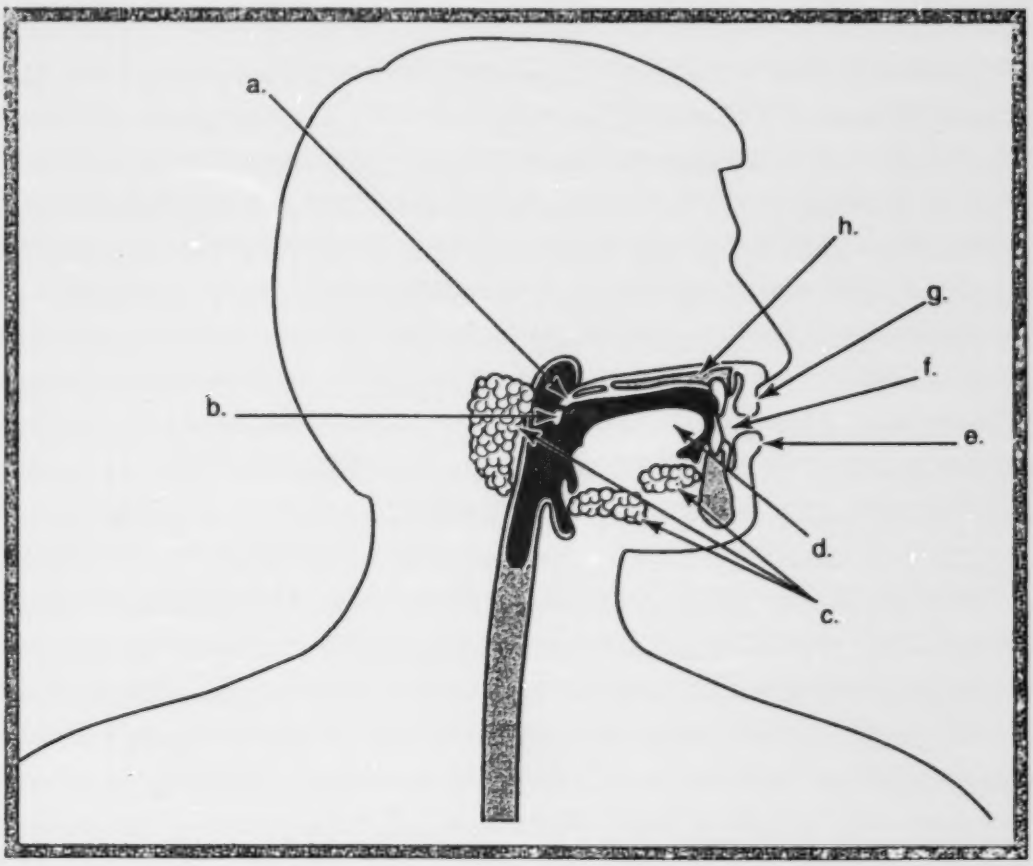
k. The _____ glands are the largest of the salivary glands; they are located under and in front of each ear and secrete clear, watery serous fluid and an enzyme called amylase.

l. The _____ salivary glands are located in the posterior portion of the floor of the mouth and secrete serous fluid with some mucus.

m. The _____ salivary glands are located in the anterior portion of the floor of the mouth and secrete thick mucus.

OBJECTIVE 9

Label the major structures of the mouth. Write your answers on the blank lines provided below the following illustration.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____ h. _____

OBJECTIVE 10

Complete statements that describe the characteristics and structures of the teeth. Write your answers on the blank lines provided in the statements below.

a. Two sets of teeth develop during life: the _____ teeth and the _____ teeth.

b. The 20 _____ teeth usually emerge sometime between 6 to 12 months after birth and are generally shed by the age of 13 years.

c. The 32 _____ teeth usually emerge between the ages of 6 and 17 years.

d. The teeth are set in sockets called _____; the _____ are lined with periodontal membrane that attaches the teeth to the socket.

e. The sockets are covered by the gums—also called the _____—which are dense connective tissue covered by mucous membrane.

f. A tooth consists of three major sections: the _____, the _____, and the _____.

g. The _____ of a tooth extends into the socket, where it is anchored by the peridontal membrane.

h. The neck is the part of the tooth that joins the _____ to the exposed portion of the tooth, which is called the *crown.*

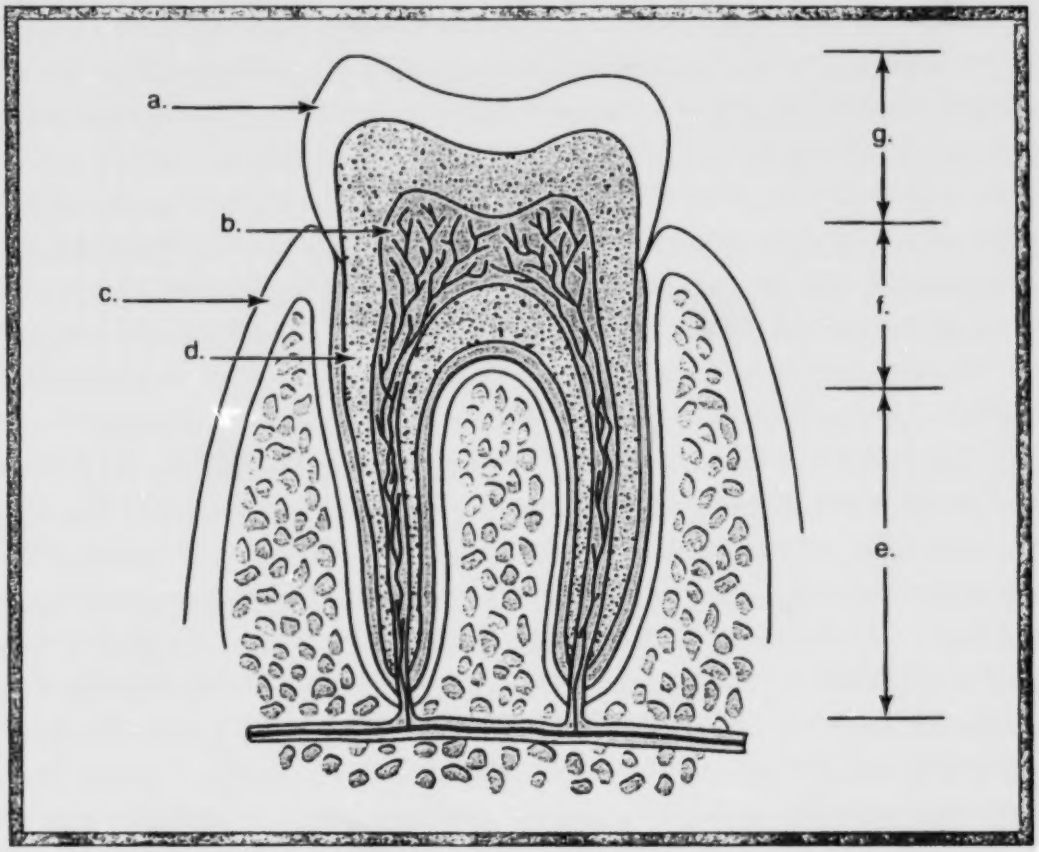
i. The _____ is covered with a hard substance called *enamel.*

j. Enamel overlays a bone-like tissue called _____.

k. Within the center portion of the tooth, nerves and blood vessels are encased in a softer tissue referred to as the _____ or _____.

Objective 11

Label the major structures of a tooth. Write your answers on the blank lines provided below the following illustration.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____

Objective 12

Define the types of teeth as classified by location and function. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Incisor _____

_____

b. Cuspid _____

_____

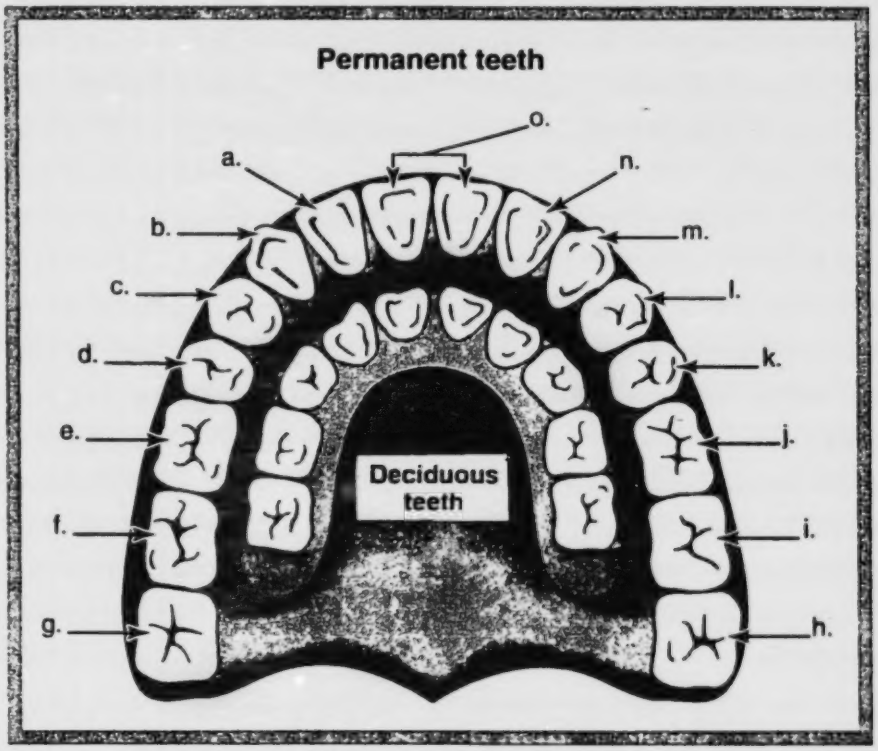
c. Premolar _____

_____

d. Molar _____

_____

OBJECTIVE 13 Label the types of teeth as classified by location and function. Write your answers on the blank lines provided below the following illustration.



a. _____ i. _____

b. _____ j. _____

c. _____ k. _____

d. _____ l. _____

e. _____ m. _____

f. _____ n. _____

g. _____ o. _____

h. _____

Objective 14 Complete statements that describe the characteristics and structures of the pharynx that relate to the digestive system. Write your answers on the blank lines provided in the statements below.

a. The pharynx consists of three parts: the _____, the _____, and the _____.

b. The _____ is located in the superior portion of the throat behind the nasal cavity above the palate.

c. The _____ is located in the middle portion of the throat behind the mouth between the palate and the hyoid bone.

d. The _____ is located in the inferior portion of the throat just above the larynx and below the hyoid bone.

Objective 15 Complete statements that describe the characteristics and structures of the esophagus. Write your answers on the blank lines provided in the statements below.

a. The esophagus is a muscular, collapsible tube about _____ inches long.

b. The top portion of the esophagus has no _____ coat as it lies in the thoracic cavity.

c. The esophagus goes through the esophageal _____ in the diaphragm in its descent from the thoracic cavity to the abdominal cavity.

d. Food is propelled into the stomach by _____, the coordinated, rhythmic contraction of smooth muscle that forces food through the digestive tract.

Objective 16 Define the major structures of the stomach. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Fundus _____

_____

b. Body _____

_____

c. Pylorus _____

_____

d. Cardiac sphincter _____

_____

e. Pyloric sphincter _____

_____

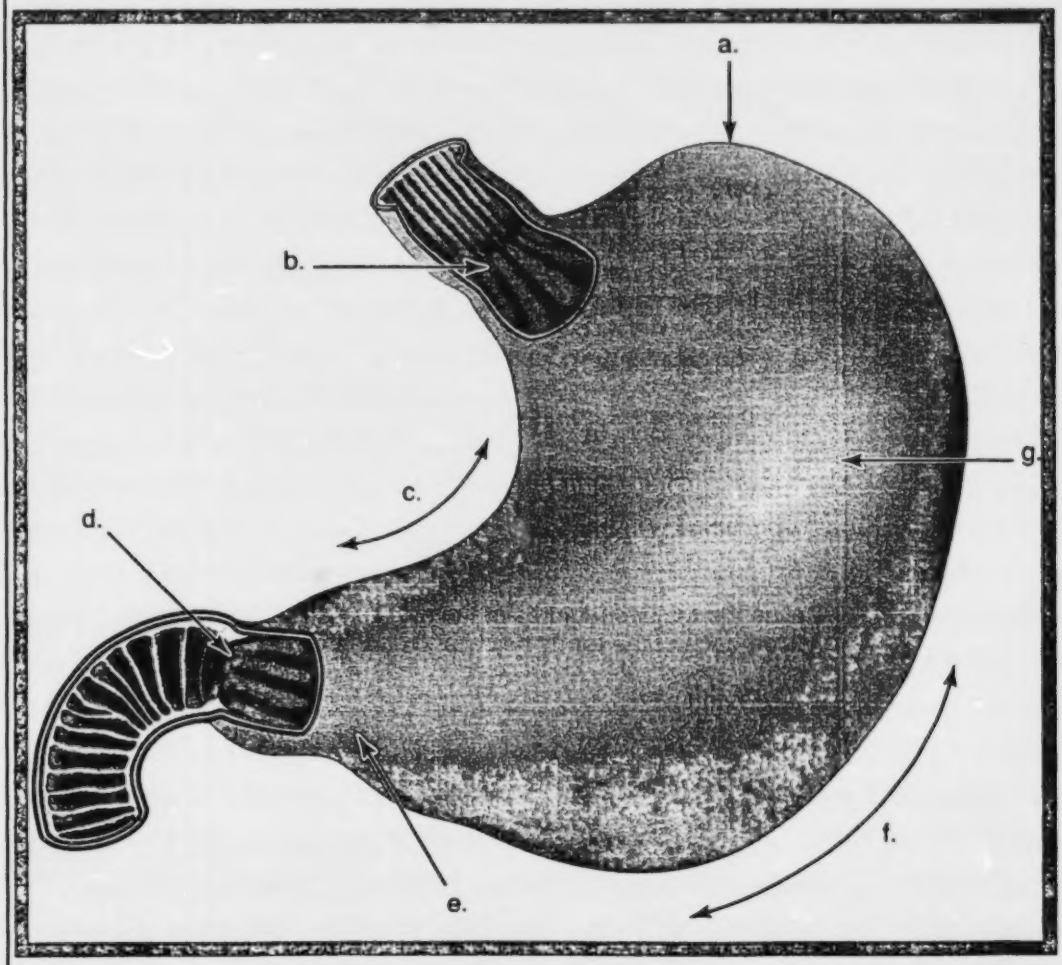
f. Lesser curvature _____

_____

g. Greater curvature _____

_____

OBJECTIVE 17 Label the major structures of the stomach. Write your answers on the blank lines provided on the next page.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____

Objective 18

Complete statements that describe the characteristics and functions of the stomach. Write your answers on the blank lines provided in the statements below.

a. The stomach is an elongated, flexible pouch that varies in size because it is able to _____ according to the amount of food contained within it.

b. The lining of the stomach—called the _____—contains folds called *rugae*.

c. When there is little or no food or drink in the stomach, the rugae _____, making the stomach smaller; as the stomach fills, the rugae _____, making the stomach larger.

d. Normally, the stomach can hold up to approximately _____ quarts until the chyme is ready to be received into the small intestine.

e. The mucosa contains glands and gland openings called *gastric pits*; cells in the gastric pits secrete three primary gastric juices: _____, _____, and _____.

f. _____ coats and protects the stomach against acid; _____ converts into pepsin in the presence of hydrochloric acid, and pepsin is an enzyme that breaks down _____.

Objective 19

Define the major structures of the small intestine. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Duodenum _____

_____

b. Jejunum _____

_____

c. Ileum _____

_____

d. Ileocecal valve _____

_____

_____

OBJECTIVE 20 Complete statements that describe the characteristics and functions of the small intestine. Write your answers on the blank lines provided in the statements below.

a. Most _____ and _____ occurs in the small intestine.

b. The small intestine contains _____ and villi—microscopic, velvety, finger-like projections.

c. Each villus consists of a lymph channel called a _____, which absorbs fats.

d. The _____ and the _____ increase the surface area of the small intestine, slowing the movement of chyme, exposing the chyme to more digestive secretions, and allowing more nutrients to be absorbed through the intestine.

e. As food is digested, nutrients pass into the _____ and _____ of the villi.

OBJECTIVE 21 Define the major structures of the large intestine. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Cecum _____

_____

b. Vermiform appendix _____

_____

c. Colon _____

_____

d. Rectum _____

_____

e. Anal canal _____

_____

OBJECTIVE 22 Define the sections and flexures of the colon. Write your answers on the blank lines provided beside each of the terms below.

a. Ascending colon _____

_____

_____

_____

b. Hepatic flexure _____

_____

_____

_____

c. Transverse colon _____

_____

_____

_____

d. Splenic flexure _____

_____

_____

_____

e. Descending colon _____

_____

_____

_____

f. Sigmoid colon _____

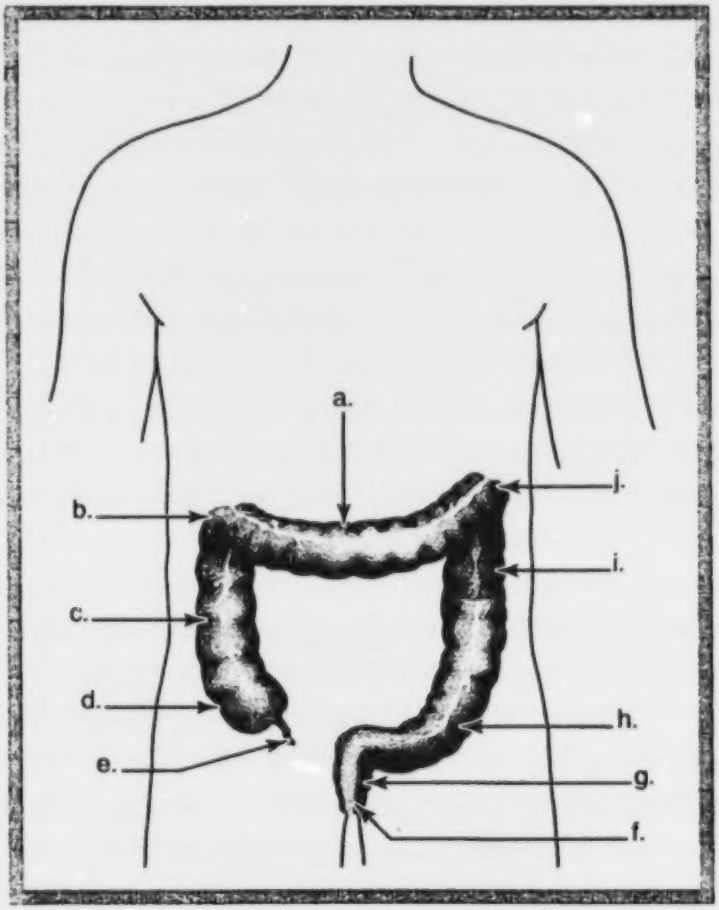
_____

_____

_____

OBJECTIVE 23

Label the major structures of the large intestine. Write your answers on the blank lines provided below the following illustration.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____ j. _____

OBJECTIVE 24

Complete statements that describe the characteristics and functions of the large intestine. Write your answers on the blank lines provided in the statements below and on the next page.

a. The principal functions of the colon are to _____ water, minerals, and vitamins and to _____ waste.

b. Three bands of muscle give the colon its structure, with the rest of the colon gathered to these bands in pouches called _____, which increase the surface area of the colon and allow the large intestine to expand.

c. As feces cause the colon to expand, the defecation reflex sets off _____ to move feces through the intestine and toward the anal canal.

d. The mucous lining of the large intestine has no villi and the large intestine does not secrete enzymes, but it does secrete _____ to help lubricate feces as they move through the colon.

e. The mucous lining of the large intestine contains _____ and solitary _____.

OBJECTIVE 25 Complete statements that describe the characteristics and structures of the liver. Write your answers on the blank lines provided in the statements below and on the next page.

a. The liver is completely covered by a tough, fibrous sheath called _____.

b. The upper convex surface of the liver fits under the _____.

c. The lower concave portion of the liver fits over the _____, _____ colon, and _____ end of the stomach.

d. The liver is the first organ to receive _____ from the intestines after nutrient absorption.

e. Blood is provided to the liver through the _____ so that the liver can detoxify the blood before it returns to the _____.

f. The liver is divided into two main lobes: the _____ lobe and the _____ lobe.

g. The _____ lobe is the largest lobe and constitutes approximately 80 percent of the total mass of the liver.

h. The _____ lobe is the smaller wedge-shaped lobe.

i. The _____ lobe is divided into sublobes: the quadate lobe, the caudate lobe, and the spigelli lobe.

j. The entire liver is subdivided into _____, each served by a small branch of the hepatic vein.

k. The lobes and _____ are separated by blood vessels and by fibrous strands of _____ membrane peritoneum that are called *ligaments*.

l. The major ligament of the liver is called the _____, which separates the liver into the right and left lobes.

m. Small bile ducts within the liver join to form two larger ducts that emerge from under the concave surface of the liver as the _____ and _____ hepatic ducts and immediately join to form the _____ hepatic duct.

n. The _____ hepatic duct joins the cystic duct from the gallbladder to form the _____ duct.

o. The _____ duct opens into the duodenum at an enlargement called the _____, which is located 3 to 4 inches below the pyloric opening of the _____.

p. The neck of the ampulla of Vater is guarded by a sphincter muscle called the _____.

OBJECTIVE 26

List ten of the functions of the liver. Write your answers on the blank lines provided below and on the next page.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

e. _____

_____

f. _____

_____

g. _____

_____

h. _____

_____

i. _____

_____

j. _____

_____

OBJECTIVE 27 Complete statements that describe the characteristics and structures of the pancreas. Write your answers on the blank lines provided in the statements below and on the next page.

a. The pancreas lies transversely behind the _____ and _____, and the body of the pancreas extends horizontally across the posterior abdominal wall.

b. The pancreas is divided into the _____, _____, and _____.

c. The _____ of the pancreas fills the C-curve of the duodenum, to which it is firmly attached.

d. The _____ of the pancreas touches the spleen.

e. The pancreas varies in size according to the sex of the person and other individual factors, but it is generally _____ inches long, _____ inches in width, and _____ inch thick and weighs _____ ounces.

f. Special cells of the pancreas manufacture pancreatic juice, which is carried by the pancreatic duct to the _____.

g. The pancreatic duct—called the _____—and the common bile duct unite to form the _____.

h. The pancreas also has special cells called _____ that lie in clusters between the pancreatic cells and are scattered throughout its structure.

i. The _____ produce insulin and glucagon, which are absorbed directly into the blood vessels.

OBJECTIVE 28 Complete statements that describe the characteristics and structures of the gallbladder. Write your answers on the blank lines provided in the statements below.

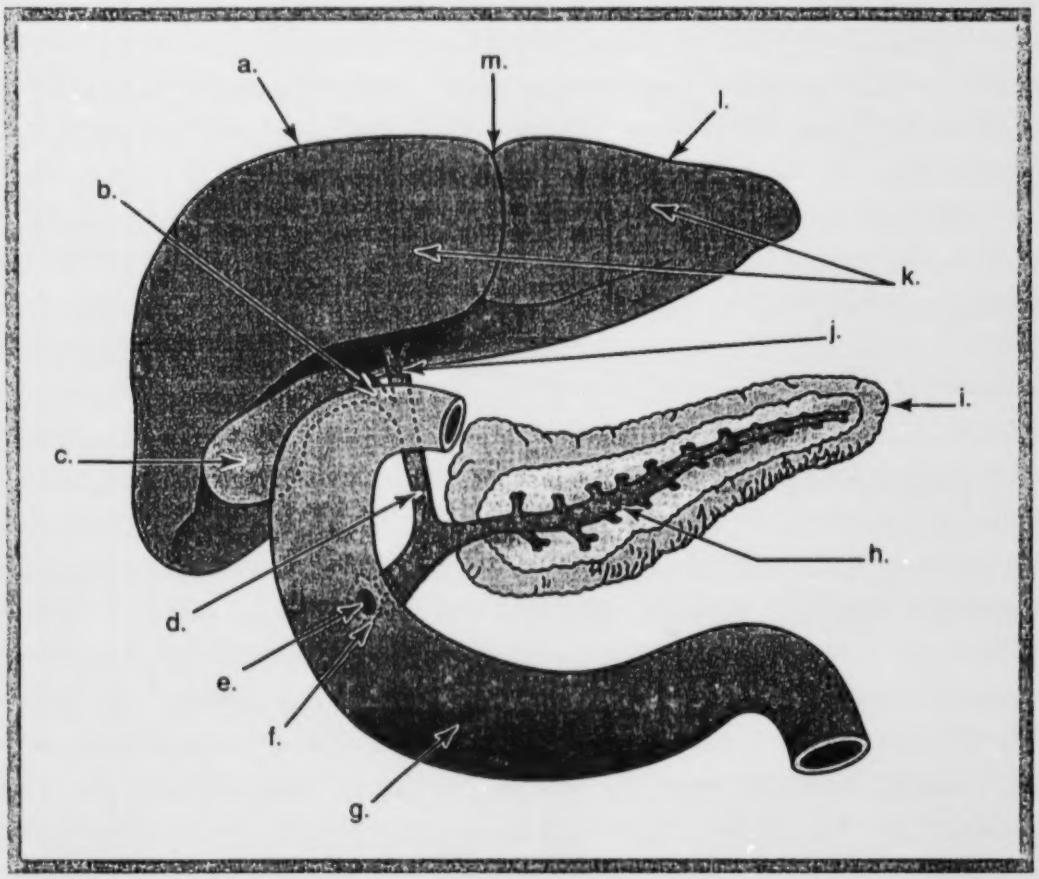
a. The gallbladder is about _____ inches long, _____ inch wide, and holds about _____ cubic inches of bile.

b. The gallbladder consists of three layers: the inner _____ layer, the middle _____ and _____ layer, and the outer _____ layer.

c. The gallbladder and bile ducts have _____ in their walls that are capable of contracting and forcing bile into the duodenum.

OBJECTIVE 29

Label the major structures of the liver, pancreas, and gallbladder. Write your answers on the blank lines provided below the following illustration.



a. _____ h. _____

b. _____ i. _____

c. _____ j. _____

d. _____ k. _____

e. _____ l. _____

f. _____ m. _____

g. _____

OBJECTIVE 30

Match common disorders and abnormalities of the alimentary tract to their correct definitions. Write the numbers on the blanks provided below. Terms and definitions continue on the following pages.

_____ a. Any of various conditions that results from the introduction of pathogens or pathogenic toxins through the consumption of food that has been improperly cooked or stored

_____ b. An inflammation of the large intestine characterized by severe diarrhea, bleeding, and ulceration of the mucosa of the intestine

_____ c. Cancer of the colon or rectal area

_____ d. An inflammation of the vermiform appendix that is usually acute and is characterized by constant pain in the right lower quadrant of the abdomen

_____ e. The presence of pouchlike herniations through the muscular layer of the colon—particularly the sigmoid colon—that is characterized by bleeding from the rectum

_____ f. A condition of liver deterioration marked by the buildup of scar tissue when damage to the liver occurs at a rate faster than the liver is able to repair itself

_____ g. A loss of appetite

_____ h. A condition of unusually frequent and often watery or loose bowel movements that can be symptomatic of a number of diseases, conditions, and emotional states

_____ i. An ulcer of the duodenum characterized by a gnawing pain

_____ j. A condition of unusually infrequent and often difficult bowel movements that can be symptomatic of a number of diseases or conditions

_____ k. An abnormal passageway that develops between the rectal wall and the skin, often in association with bowel diseases such as Crohn's disease

_____ l. A gallstone; a stone formed in the gallbladder or bile ducts, consisting of cholesterol or bile pigments and calcium salts and causing pain in the right upper quadrant, obstruction, and inflammation

_____ m. Vomiting

1. Anal fistula
2. Anorexia
3. Appendicitis
4. Biliary calculus
5. Cirrhosis
6. Colitis
7. Colorectal cancer
8. Constipation
9. Diarrhea
10. Diverticulosis
11. Duodenal ulcer
12. Emesis
13. Food poisoning

_____ n. Any of various conditions that result in the inability of the digestive system, especially the small intestine, to absorb nutrients

_____ o. Inflammation of the stomach and intestines that accompanies numerous disorders of the alimentary tract and is characterized by anorexia, nausea, vomiting, abdominal discomfort, and diarrhea

_____ p. A condition in which bilirubin is eliminated through the bloodstream instead of through the feces, resulting in yellowish discoloration of the skin, mucous membranes, and eyes and often a grayish discoloration of the feces

_____ q. A sensation of burning behind the sternum and other symptoms as a result of gastric acids escaping into the esophagus that is often caused by excessive pressure on the cardiac sphincter or a weakening of that opening

_____ r. A condition in which an organ is unable to process a substance, such as a type of food, that would normally be processed

_____ s. Inflammation of the liver caused by several different viruses, though the vast majority of cases are caused by one of three strains of viruses, leading to the designations A, B, and C

_____ t. A viral infection that causes swelling of the parotid salivary glands and is most likely to affect children between 5 and 15 years of age, but may occur at any age

_____ u. An ulcer of the stomach lining characterized by episodes of burning pain, belching, and nausea

_____ v. An enlarged, abnormally dilated vein of the anal canal

_____ w. Cancer of the liver

_____ x. A condition often brought on by stress that results in diarrhea or constipation

_____ y. Inflammation or infection of the gums in which the gums are swollen and red and bleed

_____ z. Misalignment of teeth due to the positioning of the jaw, to alignment of individual teeth, or to missing teeth

14. Gastric ulcer
15. Gastroenteritis
16. Gingivitis
17. Heartburn
18. Hemorrhoid
19. Hepatitis
20. Intolerance
21. Irritable-bowel syndrome
22. Jaundice
23. Liver cancer
24. Malabsorption syndrome
25. Malocclusion
26. Mumps

_____ aa. Permanent damage to the enamel and often underlying layers of a tooth as a result of the chemical actions of acids produced by bacteria, particularly where food and plaque accumulate

_____ bb. The loss of peristalsis in the intestine, causing the movement of chyme through the digestive system to cease

_____ cc. Abnormal narrowing of the pyloric opening, which is generally the result of a birth defect but may be a symptom of some physical condition such as scarring or tumoral growth

_____ dd. An urge to vomit or unsettled feeling in the stomach that may also be associated with an aversion to food

_____ ee. Inflammation of the structures that attach the tooth to the bones of the jaw, which include the periodontal ligament, the gingiva, and the alveolar bone

_____ ff. Inflammation of the rectum and anus caused by infection, trauma, drugs, allergy, or radiation injury and characterized by rectal discomfort and the repeated urge to pass feces with the inability to do so

_____ gg. Cancer of the stomach

_____ hh. Inflammation of the pancreas, particularly as a result of blockage of the pancreatic duct

_____ ii. Cancer of the pancreas

_____ jj. An inflammation of the peritoneum that is produced by bacteria or irritating substances introduced into the abdominal cavity by a penetrating wound or perforation of an organ

27. Nausea
28. Pancreatic cancer
29. Pancreatitis
30. Paralytic ileus
31. Periodontitis
32. Peritonitis
33. Proctitis
34. Pyloric stenosis
35. Stomach cancer
36. Tooth decay

Answers to Written Test

Objective 1

The organs, structures, and accessory glands of the digestive tube of the body through which food passes from the mouth to the anus

Objective 2

Answers may appear in any order.

a. To convert the complex organic-compound molecules of ingested food into simple organic and inorganic compounds that are capable of being transported by the circulatory and lymphatic systems and being used by cells to produce energy

b. To convert nutrients into energy at the cellular level

c. To convert excess nutrients into fat for later use

d. To eliminate from the body the by-products of digestion that are not used by the cells or stored

Objective 3

The digestive tube; the muscular tube that extends from the mouth to the anus

Objective 4

a. The nearly oval oral cavity at the anterior end of the alimentary tract

b. The throat; the tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for the respiratory and alimentary tracts

c. The muscular canal that extends from the pharynx to the stomach and is the narrowest part of the alimentary tract

d. The major organ of digestion that receives partially processed food and drink funneled from the esophagus and then moves nutritional bulk into the small intestine

e. The longest portion of the alimentary tract that extends from the stomach to the large intestine; the portion of the alimentary tract where digestion is completed and the end products of digestion are absorbed into the blood and lymph

f. The portion of the alimentary tract that extends from the small intestine to the anus

Objective 5

The glands of the digestive system that secrete the digestive enzymes that are used by the digestive system to break down food substances in preparation for absorption into the bloodstream before carrying the waste to the intestines for excretion

Objective 6

a. The largest gland of the body, weighing approximately 3 to 4 pounds, shaped like an irregular hemisphere, and located beneath the diaphragm in the right upper quadrant of the abdominal cavity

b. The fish-shaped gland that lies posterior and slightly inferior to the stomach and secretes various substances, such as digestive enzymes, insulin, and glucagon

c. The pear-shaped gland located on the surface of the liver and serving as a reservoir for bile

Objective 7

a. Pharynx
b. Esophagus
c. Liver
d. Gallbladder
e. Large intestine
f. Small intestine
g. Pancreas
h. Stomach
i. Mouth

Objective 8

a. cheeks; lips
b. tongue; hard palate; soft palate; teeth; salivary glands
c. tongue
d. hard palate; soft palate
e. hard palate; soft palate
f. soft palate
g. uvula
h. teeth
i. saliva; saliva
j. parotid; submandibular; sublingual
k. parotid
l. submandibular
m. sublingual

Objective 9

a. Soft palate
b. Uvula
c. Salivary glands
d. Tongue
e. Lower lip
f. Teeth
g. Upper lip
h. Hard palate

Objective 10

a. deciduous; permanent
b. deciduous
c. permanent
d. alveolar processes; alveoli
e. gingiva
f. root; neck; crown
g. root
h. root
i. crown
j. dentin
k. pulp cavity; pulp

Objective 11

a. Enamel
b. Pulp cavity
c. Gingiva
d. Dentin
e. Root
f. Neck
g. Crown

Objective 12

a. One of the eight wedge-shaped front teeth, four in each dental arch, that is adapted for biting food

b. One of four pointed teeth, two in each dental arch, that is located at the side and toward the front of the mouth and is adapted for biting and tearing food

c. One of eight teeth, four in each dental arch, that is located in the middle section of the mouth and is adapted for grinding food

d. One of twelve teeth, six in each dental arch, that is located in the posterior section of the mouth and is adapted for crushing food

Objective 13

a. Lateral incisor
b. Cuspid
c. First premolar
d. Second premolar
e. First molar
f. Second molar
g. Third molar
h. Third molar
i. Second molar
j. First molar
k. Second premolar
l. First premolar
m. Cuspid
n. Lateral incisor
o. Central incisor

Objective 14

a. nasopharynx; oropharynx; laryngopharynx
b. nasopharynx
c. oropharynx
d. laryngopharynx

Objective 15

a. 10
b. peritoneal
c. hiatus
d. peristalsis

Objective 16

a. The enlarged portion of the stomach that is located to the left and above the point where the esophagus opens into the stomach

b. The central portion of the stomach

c. The lower portion of the stomach near the opening where the stomach empties into the small intestine

d. The opening that is located at the upper end of the stomach, where the esophagus joins the stomach

e. The opening at the lower end of the stomach, where the stomach joins the small intestine

f. The upper concave edge of the stomach that extends from the cardiac sphincter to the pyloric sphincter

g. The lower convex edge of the stomach that extends from the cardiac sphincter to the pyloric sphincter

Objective 17

a. Fundus
b. Cardiac sphincter
c. Lesser curvature
d. Pyloric sphincter
e. Pylorus
f. Greater curvature
g. Body

Objective 18

a. dilate
b. mucosa
c. collapse; distend
d. 2
e. mucus; pepsinogen; hydrochloric acid
f. mucus; pepsinogen; proteins

Objective 19

a. The 10-inch-long (25-centimeter-long) upper part of the small intestine that extends from the pyloric sphincter of the stomach to the jejunum

b. The 8-foot-long (2.5-meter-long) middle part of the small intestine that extends from the duodenum to the ileum

c. The 12- to 15-foot-long (4- to 5-meter-long) lowest part of the small intestine that extends from the jejunum to the large intestine

d. The valve between the ileum of the small intestine and the cecum of the large intestine; it consists of a flap of tissue that serves as a sphincter to prevent feces from backing up into the small intestine

Objective 20

a. digestion; nutrient absorption
b. rugae
c. lacteal
d. rugae; villi
e. capillaries; lacteals

Objective 21

a. The 2- to 3-inch-long (5- to 7.5-centimeter-long) blind pouch at the beginning of the large intestine into which the ileum opens

b. The 3- to 6-inch-long (7.5- to 15-centimeter-long) wormlike process extending from the cecum

c. The approximately 5-foot-long (1.6-meter-long) portion of the large intestine that extends from the cecum to the rectum

d. The 7- to 8-inch-long (17.5- to 20-centimeter-long) portion of the large intestine that extends from the colon to the anal canal

e. The 1- to 1½-inch-long (2.5- to 3.5-centimeter-long) terminal portion of the large intestine that ends at the anus

Objective 22

a. The portion of the colon that lies in a vertical position on the right side of the abdomen and extends to the lower border of the liver, where it bends abruptly to the left

b. The abrupt bend of the ascending colon at the lower border of the liver; also called the *right colic flexure*

c. The portion of the colon that passes across the upper abdomen, below the liver and stomach, and above the small intestine, to the spleen in the upper-left abdomen, where it curves sharply downward to the right beneath the lower end of the spleen

d. The sharp downward bend of the transverse colon in the upper-left abdomen; also called the *left colic flexure*

e. The portion of the colon that lies in a vertical position on the left side of the abdomen and extends from a point below the stomach to the level of the iliac crest, where it begins an S-shaped curve

f. The portion of the colon that extends from the descending colon and curves downward in an S-shape to join the rectum

Objective 23

a. Transverse colon
b. Hepatic flexure
c. Ascending colon
d. Cecum
e. Vermiform appendix
f. Anal canal
g. Rectum
h. Sigmoid colon
i. Descending colon
j. Splenic flexure

Objective 24

a. absorb; eliminate
b. haustra
c. peristaltic motion
d. mucus
e. intestinal glands; lymph nodes

Objective 25

a. Glisson's capsule
b. diaphragm
c. kidney; ascending; pyloric
d. blood
e. portal vein; heart
f. right; left
g. right
h. left
i. right
j. lobules
k. lobules; Glisson's
l. falciform ligament
m. right; left; common
n. common; common bile
o. common bile; ampulla of Vater; stomach
p. sphincter of Oddi

Objective 26

Answers should include any ten of the following and may appear in any order.

- Produces bile, which is stored in the gallbladder and is released when needed for the digestive process
- Forms an internal secretion that regulates the conversion of glucose into glycogen
- Stores glycogen
- Converts glycogen back into glucose as it is required for body functions
- Stores iron and vitamins B_{12}, A, D, E, and K
- Changes proteins into urea for elimination
- Manufactures fibrogen and prothrombin, which are used in blood clotting
- Manufactures heparin, which helps prevent blood from clotting in intact vessels

Objective 26 (continued)

- Regulates blood volume
- Manufactures antibodies
- Removes bacteria and foreign substances from the bloodstream by phagocytosis
- Produces body heat
- Detoxifies harmful substances, such as drugs and poisons, before they make their way to the heart
- Manufactures cholesterol

Objective 27

a. stomach; duodenum
b. head; body; tail
c. head
d. tail
e. 6 to 9; 1 to 1½; 2 to 3
f. duodenum
g. duct of Wirsung; ampulla of Vater
h. islands of Langerhans
i. islands of Langerhans

Objective 28

a. 3 to 4; 1; 2
b. mucous-membrane; muscular-; fiber-tissue; serous-membrane
c. involuntary muscles

Objective 29

a. Right lobe
b. Cystic duct
c. Gallbladder
d. Common bile duct
e. Sphincter of Oddi
f. Ampulla of Vater
g. Duodenum
h. Pancreatic duct (duct of Wirsung)
i. Pancreas
j. Common hepatic duct
k. Liver
l. Left lobe
m. Falciform ligament

Objective 30

a. 13	i. 11	q. 17	y. 16	gg. 35
b. 6	j. 8	r. 20	z. 25	hh. 29
c. 7	k. 1	s. 19	aa. 36	ii. 28
d. 3	l. 4	t. 26	bb. 30	jj. 32
e. 10	m. 12	u. 14	cc. 34	
f. 5	n. 24	v. 18	dd. 27	
g. 2	o. 15	w. 23	ee. 31	
h. 9	p. 22	x. 21	ff. 33	

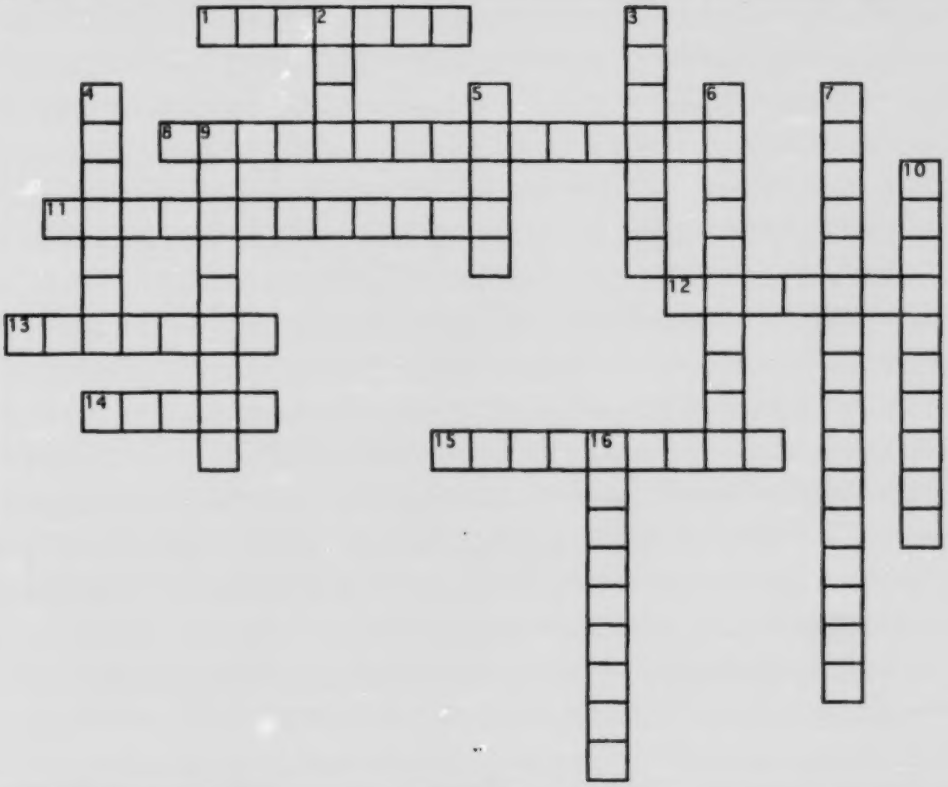
Answers to Assignment Sheet

Assignment Sheet 1

Answers must be evaluated to the satisfaction of the instructor according to the organ/conditions assigned to the student.

Crossword Puzzle 1—Terms from Objectives 1 and 2

Name _____ Date _____



ACROSS

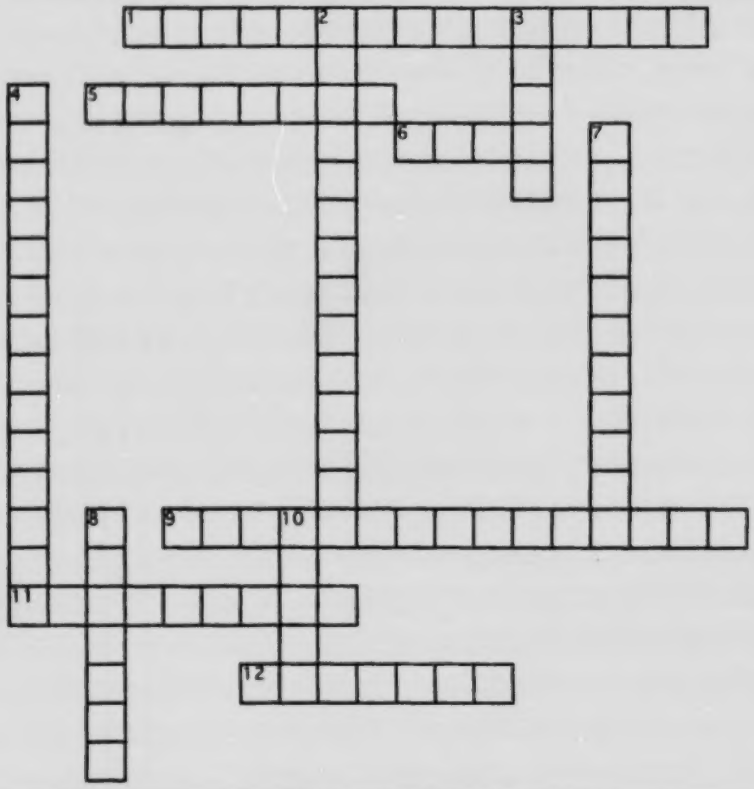
1. Related to those chemicals that contain carbon and are commonly found as the building blocks of living things
8. The organs, structures, and accessory glands of the digestive tube of the body through which food passes from the mouth to the anus (2 words)
11. Any of various compounds that include carbon, hydrogen, and oxygen, including sugars, starches, and cellulose, most of which are produced by green plants
12. The amount of heat required to raise the temperature of a kilogram of water one degree Celsius at normal atmospheric pressure at sea level; also the amount of energy-producing potential in food equal to 1 calorie of heat
13. Any of various inorganic substances including metals (iron, zinc), salts, water, and most normally solid inorganic chemicals
14. A family of organic compounds that include true fats, phospholipids, and steroids such as cholesterol
15. A substance that is the structural component of many vegetables

DOWN

2. The posterior opening of the alimentary tract
3. Any of various organic compounds that contain carbon, oxygen, hydrogen, and nitrogen that are synthesized from raw materials by plants and used as amino acids by animals
4. Any of various organic substances that are essential to promote bodily processes but which in themselves do not supply energy or serve as building blocks for the body
5. Defecated wastes consisting primarily of cellulose and water
6. The building blocks of proteins; many are derived from breaking down proteins and are used by the body as enzymes and catalysts in chemical reactions (2 words)
7. The units of measure applied to a kilogram of water as opposed to a gram calorie, which is one-thousandth of a kilogram calorie or large calorie; also called *kilocalories* (2 words)
9. All other chemicals not classified as organic
10. The act of discharging body wastes through the anus
16. The process of eliminating chiefly fluid wastes from the body, including dissolved proteins, vitamins, and salts and other minerals

Crossword Puzzle 2—Terms from Objectives 3 Through 6

Name _____ Date _____



ACROSS

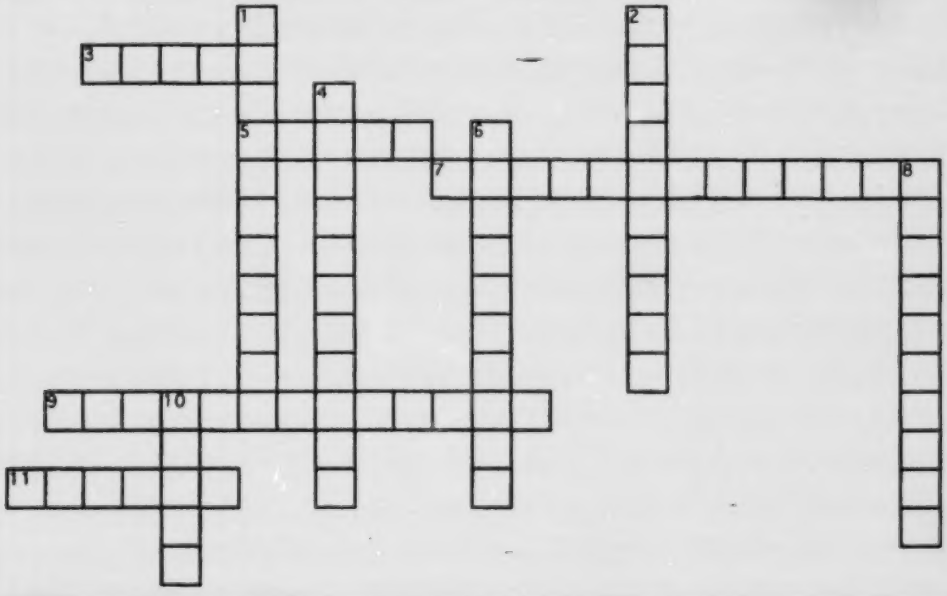
1. The glands of the digestive system that secrete the digestive enzymes that are used by the digestive system to break down food substances in preparation for absorption into the bloodstream before carrying the waste to the intestines for excretion (2 words)
5. The fish-shaped gland that lies posterior and slightly inferior to the stomach and secretes various substances, such as digestive enzymes, insulin, and glucagon
6. The bitter, yellow-green secretion of the liver that is stored in the gallbladder and passes from the gallbladder in response to the presence of a fatty meal in the stomach
9. The digestive tube; the muscular tube that extends from the mouth to the anus; also called the *digestive tract, gastrointestinal* (GI) *tract, alimentary canal, intestinal tract,* and *intestinal tube* (2 words)
11. The muscular canal that extends from the pharynx to the stomach and is the narrowest part of the alimentary tract
12. The throat; the tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for the respiratory and alimentary tracts

DOWN

2. The longest portion of the alimentary tract that extends from the stomach to the large intestine; the portion of the alimentary tract where digestion is completed and the end products of digestion are absorbed into the blood and lymph; also called the *small bowel* (2 words)
3. The largest gland of the body, weighing approximately 3 to 4 pounds, shaped like an irregular hemisphere, and located beneath the diaphragm in the right upper quadrant of the abdominal cavity
4. The portion of the alimentary tract that extends from the small intestine to the anus; also called the *large bowel* (2 words)
7. The pear-shaped gland located on the surface of the liver and serving as a reservoir for bile
8. The major organ of digestion that receives partially processed food and drink funneled from the esophagus and then moves nutritional bulk into the small intestine
10. The nearly oval oral cavity at the anterior end of the alimentary tract

Crossword Puzzle 3—Terms from Objective 8

Name _____ Date _____



ACROSS

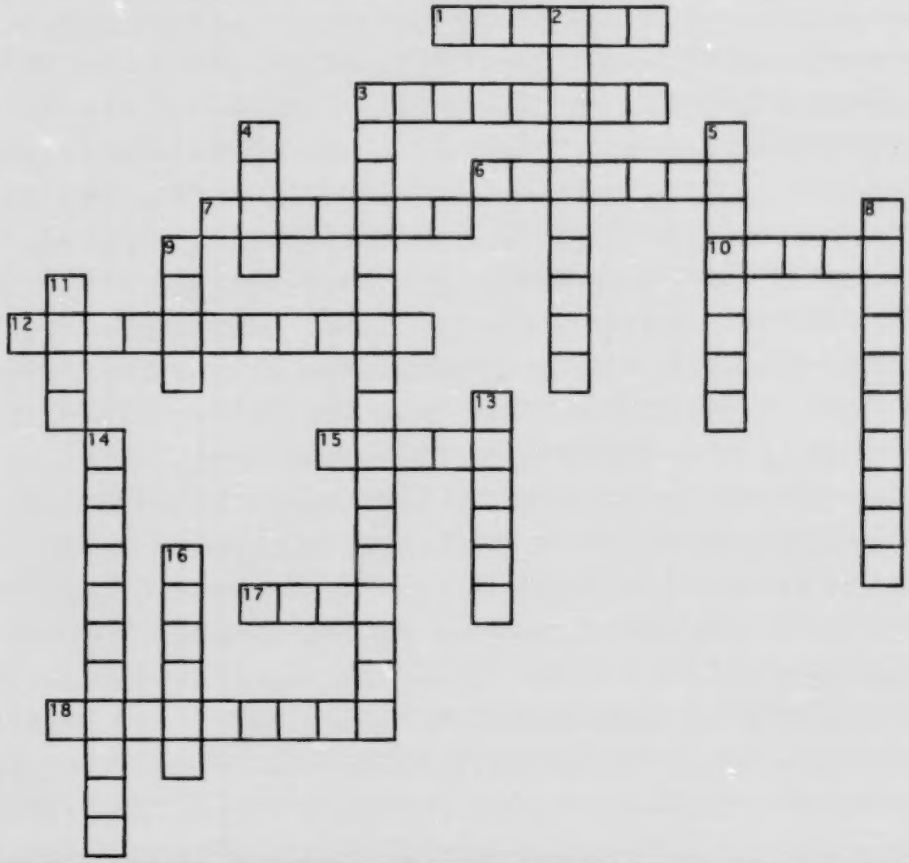
3. The conical structure that hangs from the posterior border of the soft palate
5. The hard, bony structures on the bones of the mouth that mechanically break down food into smaller pieces during mastication
7. The largest of the salivary glands; they are located under and in front of each ear and secrete clear, watery serous fluid and an enzyme called *amylase* (2 words)
9. These salivary glands are located in the posterior portion of the floor of the mouth and secrete serous fluid with some mucus
11. The structure that forms most of the floor of the mouth and assists in mastication and deglutition of food

DOWN

1. Grinding or crushing food with the teeth
2. These salivary glands are located in the anterior portion of the floor of the mouth and secrete thick mucus
4. The process of swallowing
6. The structure composed of bone that forms the anterior part of the roof of the mouth (2 words)
8. The structure that is composed of mucous membrane, muscular fibers, and mucous glands suspended from the posterior border of the hard palate (2 words)
10. The oral cavity enclosed by the cheeks (also called the *bucca*) and lips; also called the *buccal cavity*; contains salivary glands that secrete saliva

Crossword Puzzle 4—Terms from Objectives 10 Through 12

Name _____ Date _____



ACROSS

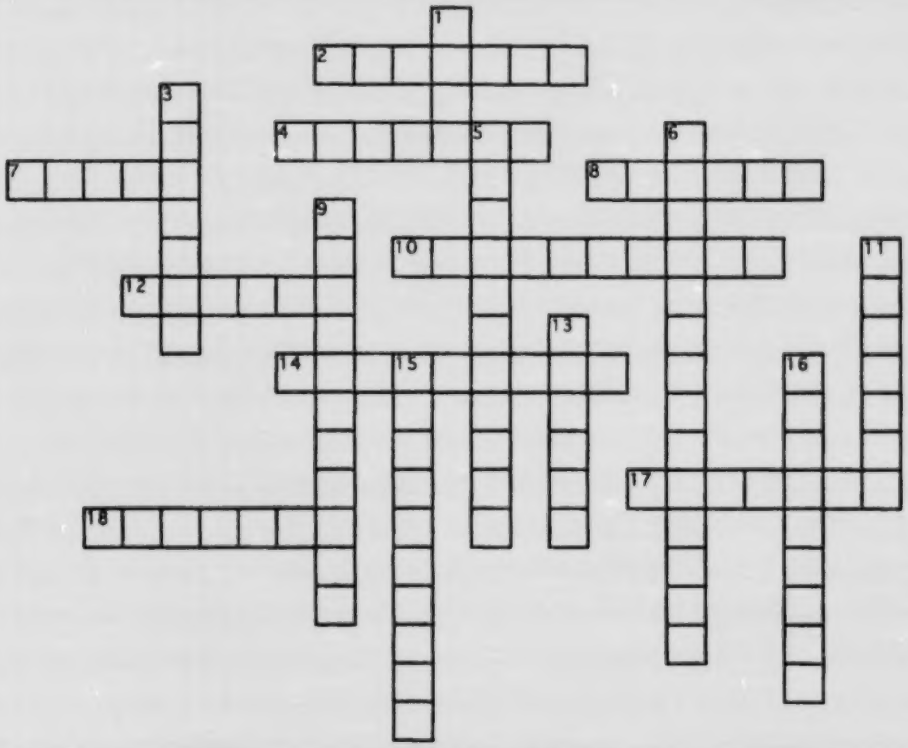
1. One of four pointed teeth, two in each dental arch, that is located at the side and toward the front of the mouth and is adapted for biting and tearing food; also called the *canine teeth*
3. A small, saclike structure
6. One of the eight wedge-shaped front teeth, four in each dental arch, that is adapted for biting food
7. A natural growth that projects from a bone
10. One of twelve teeth, six in each dental arch, that is located in the posterior section of the mouth and is adapted for crushing food
12. Of or pertaining to the area around the tooth
15. The part of a tooth that is exposed
17. The part of the mouth that consists of dense connective tissue covered by mucous membrane and covers the sockets in which teeth are set; also called the *gingiva*
18. Referring to a structure that is given up at the end of a growth period

DOWN

2. The soft tissue that encases nerves and blood vessels within the center portion of a tooth; also called *pulp* (2 words)
3. The sockets in which teeth are set (2 words)
4. Prefix meaning "all around" or "surrounding"
5. One of eight teeth, four in each dental arch, that is located in the middle section of the mouth and is adapted for grinding food; also called the *bicuspids*
8. The first and second molars
9. The part of a tooth that extends into the socket, where it is anchored by the peridontal membrane
11. The part of a tooth that joins the root to the crown
13. A hard substance covering the crown of a tooth
14. The third molars (2 words)
16. A bone-like tissue beneath the enamel

Crossword Puzzle 5—Terms from Objectives 14 Through 16

Name _____ Date _____



ACROSS

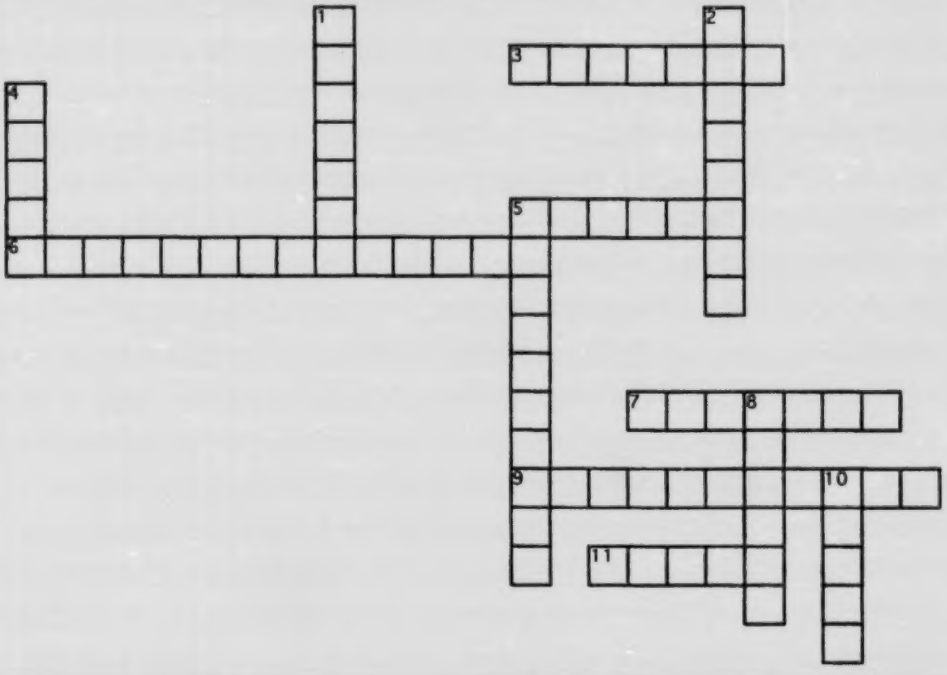
2. The lower portion of the stomach near the opening where the stomach empties into the small intestine
4. The _____ consists of three parts: the nasopharynx, the oropharynx, and the laryngopharynx
7. The semifluid mass of partly digested food expelled by the stomach into the small intestine
8. A normal opening in a membrane or other body tissue
10. Part of the pharynx located in the middle portion of the throat behind the mouth between the palate and the hyoid bone
12. The upper concave edge of the stomach that extends from the cardiac sphincter to the pyloric sphincter is called the _____ *curvature*
14. A muscular, collapsible tube about 10 inches long
17. The opening that is located at the upper end of the stomach, where the esophagus joins the stomach is the _____ sphincter
18. The stomach and intestinal contents that are expelled by vomiting

DOWN

1. The central portion of the stomach
3. The lower convex edge of the stomach that extends from the cardiac sphincter to the pyloric sphincter is called the _____ *curvature*
5. Part of the pharynx located in the superior portion of the throat behind the nasal cavity above the palate
6. Part of the pharynx located in the inferior portion of the throat just above the larynx and below the hyoid bone
9. The coordinated, rhythmic contraction of smooth muscle that forces food through the digestive tract
11. The opening at the lower end of the stomach, where the stomach joins the small intestine is the _____ sphincter
13. The enlarged portion of the stomach that is located to the left and above the point where the esophagus opens into the stomach
15. Relating to the smooth, transparent serous membrane that lines the cavity of the abdomen
16. A circular band of muscle fibers that constricts a passage or closes a natural opening in the body

Crossword Puzzle 6—Terms from Objectives 18 Through 20

Name _____ Date _____



ACROSS

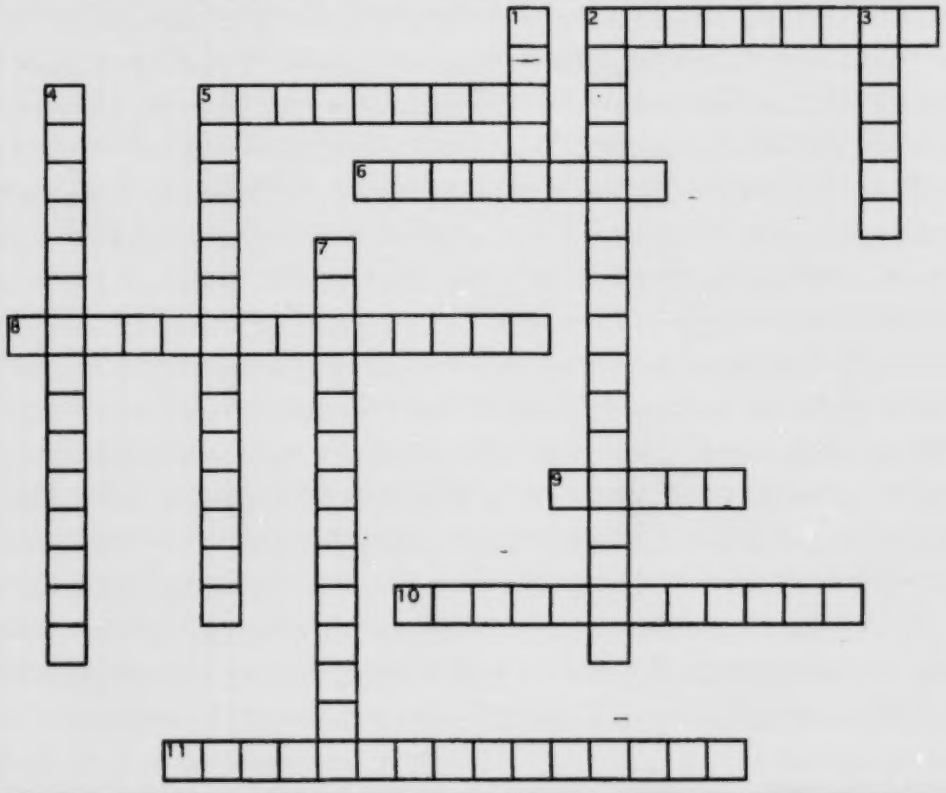
3. The 8-foot-long middle part of the small intestine that extends from the duodenum to the ileum
5. An enzyme that breaks down proteins
6. The valve between the ileum of the small intestine and the cecum of the large intestine; it consists of a flap of tissue that serves as a sphincter to prevent feces from backing up into the small intestine (2 words)
7. An elongated, flexible pouch that varies in size because it is able to dilate according to the amount of food contained within it
9. The _____ secrete three primary gastric juices: mucus, pepsinogen, and hydrochloric acid (HCL) (2 words)
11. _____ coats and protects the stomach against acid

DOWN

1. A lymph channel that absorbs fats
2. The 10-inch-long upper part of the small intestine that extends from the pyloric sphincter of the stomach to the jejunum
4. Microscopic, velvety, finger-like projections located in the small intestine
5. _____ converts into pepsin in the presence of hydrochloric acid
8. The lining of the stomach; contains folds called *rugae*; contains glands and gland openings called *gastric pits*
10. The 12- to 15-foot-long lowest part of the small intestine that extends from the jejunum to the large intestine

Crossword Puzzle 7—Terms from Objectives 21 and 22

Name _____ Date _____



ACROSS

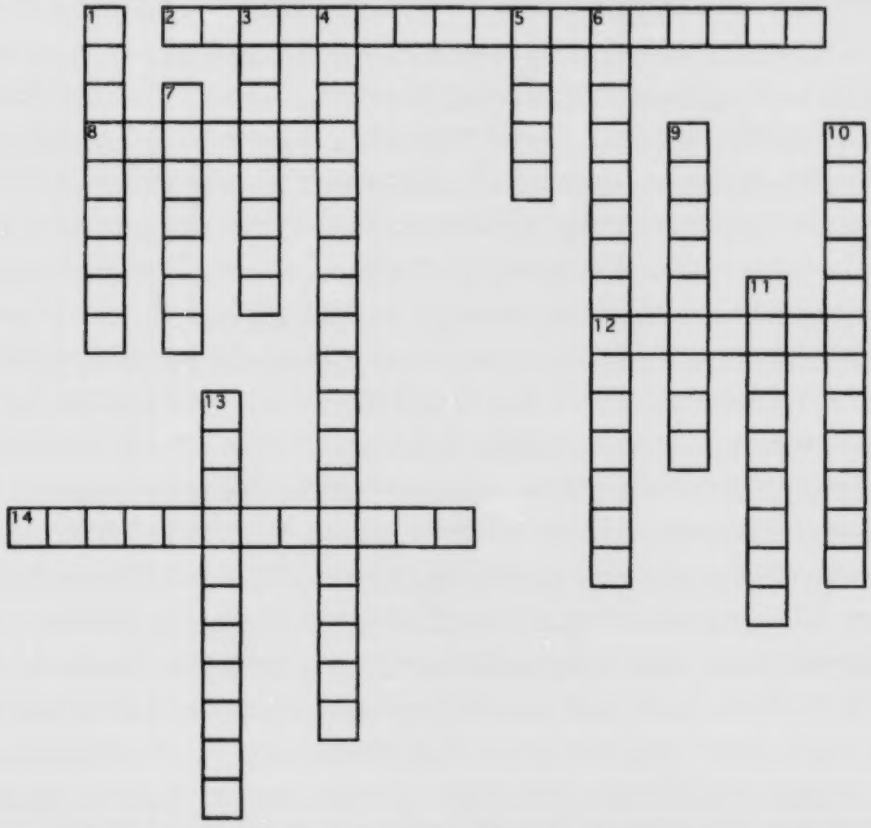
2. Resembling a worm
5. The 1- to 1½-inch-long terminal portion of the large intestine that ends at the anus (2 words)
6. An accessory part of a main structure
8. The abrupt bend of the ascending colon at the lower border of the liver; also called the *right colic flexure* (2 words)
9. The 2- to 3-inch-long blind pouch at the beginning of the large intestine into which the ileum opens
10. The portion of the colon that extends from the descending colon and curves downward in an S-shape to join the rectum (2 words)
11. The portion of the colon that lies in a vertical position on the left side of the abdomen and extends from a point below the stomach to the level of the iliac crest, where it begins an S-shaped curve (2 words)

DOWN

1. The approximately 5-foot-long portion of the large intestine that extends from the cecum to the rectum; a continuous tube that is divided into four sections
2. The 3- to 6-inch-long wormlike process extending from the cecum; also called the *cecal appendix* (2 words)
3. The 7- to 8-inch-long portion of the large intestine that extends from the colon to the anal canal
4. The portion of the colon that passes across the upper abdomen, below the liver and stomach, and above the small intestine, to the spleen in the upper-left abdomen, where it curves sharply downward to the right beneath the lower end of the spleen (2 words)
5. The portion of the colon that lies in a vertical position on the right side of the abdomen and extends to the lower border of the liver, where it bends abruptly to the left (2 words)
7. The sharp downward bend of the transverse colon in the upper-left abdomen; also called the *left colic flexure* (2 words)

Crossword Puzzle 8—Terms from Objectives 24 Through 27

Name _____ Date _____



ACROSS

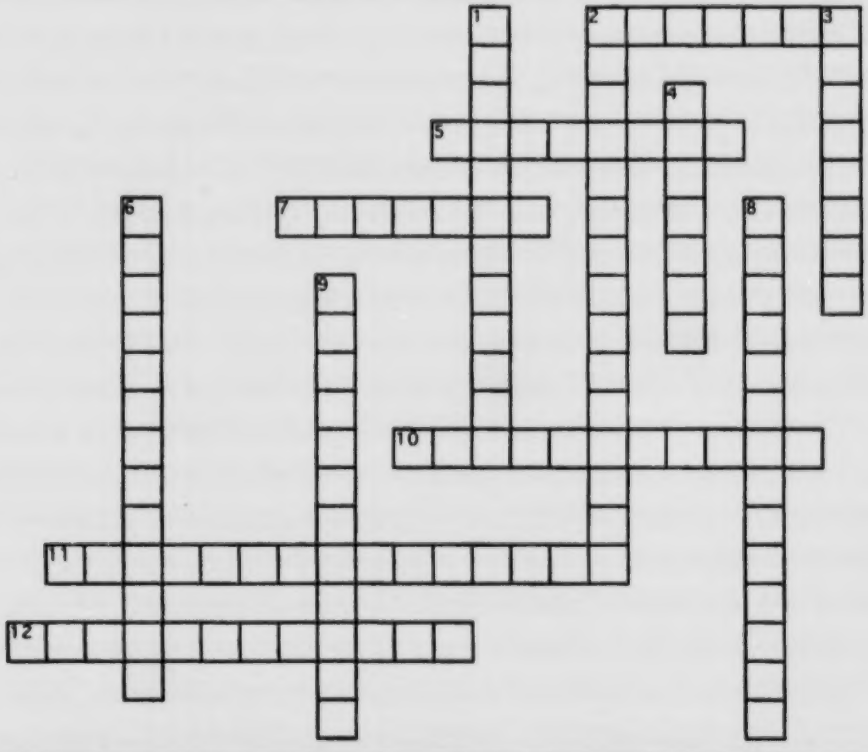
2. The major ligament of the liver that separates the liver into the right and left lobes (2 words)
8. Pouches that increase the surface area of the colon and allow the large intestine to expand
12. Having a tail
14. A condition caused when the blood-glucose level drops too low for normal functioning

DOWN

1. The largest lobe of the liver; constitutes approximately 80 percent of the total mass of the liver; divided into sublobes: the quadate lobe, the caudate lobe, and the spigelli lobe (2 words)
3. The smaller wedge-shaped lobe of the liver (2 words)
4. Special cells in the pancreas that produce insulin and glucagon, which are absorbed directly into the blood vessels (3 words)
5. The first organ to receive blood from the intestines after nutrient absorption; divided into two main lobes: the right lobe and the left lobe; produces bile
6. The tough, fibrous sheath that completely covers the liver (2 words)
7. Four-sided
9. A component of bile
10. Macrophages contained in the liver (2 words)
11. Shaped like a sickle
13. A steroid synthesized by the liver and used in the walls of cells

Crossword Puzzle 9—Terms from Objective 30

Name _____ Date _____



ACROSS

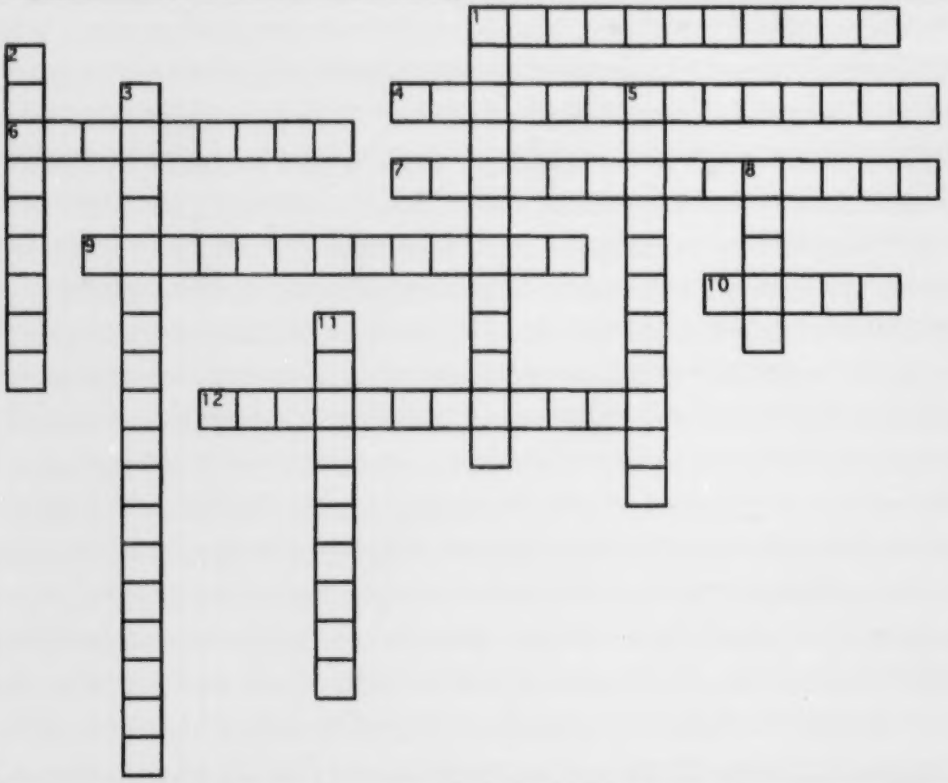
2. Of or relating to the pylorus, the opening from the stomach into the intestine
5. Any abnormal narrowing or constriction of an opening or duct
7. Of or relating to the stomach
10. An inflammation of the peritoneum that is produced by bacteria or irritating substances introduced into the abdominal cavity by a penetrating wound or perforation of an organ
11. A gallstone; a stone formed in the gallbladder or bile ducts, consisting of cholesterol or bile pigments and calcium salts and causing pain in the right upper quadrant, obstruction, and inflammation (2 words)
12. Surgical procedure that addresses appendicitis

DOWN

1. An ulcer of the stomach lining characterized by episodes of burning pain, belching, and nausea (2 words)
2. Abnormal narrowing of the pyloric opening, which is generally the result of a birth defect but may be a symptom of some physical condition such as scarring or tumoral growth (2 words)
3. A hard mass of mineral salts around organic material found especially in hollow organs or ducts
4. Of or relating to or conveying bile
6. An ulcer of the duodenum characterized by a gnawing pain (2 words)
8. The presence of pouchlike herniations through the muscular layer of the colon—particularly the sigmoid colon—that is characterized by bleeding from the rectum
9. An inflammation of the vermiform appendix that is usually acute and is characterized by constant pain in the right lower quadrant of the abdomen

Crossword Puzzle 10—Terms from Objective 30 (cont.)

Name _____ Date _____



ACROSS

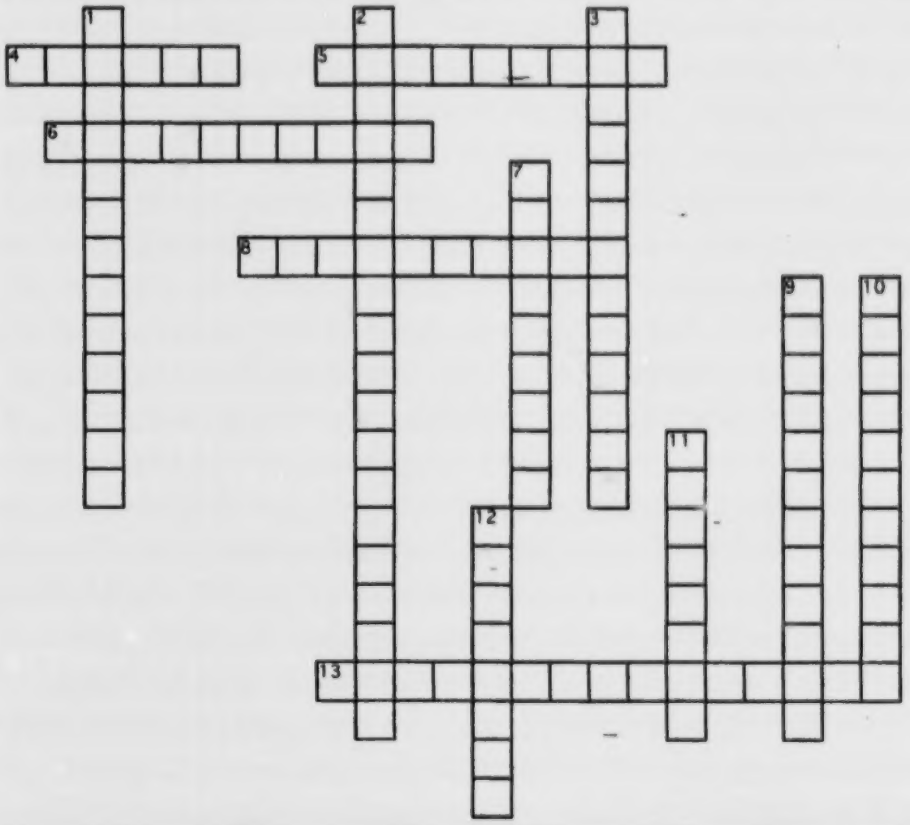
1. Pouchlike herniations through the muscle layer of the colon
4. A condition in which diverticula become infected and inflamed
6. Affected with paralysis
7. The loss of peristalsis in the intestine, causing the movement of chyme through the digestive system to cease (2 words)
9. Any of various conditions that results from the introduction of pathogens or pathogenic toxins through the consumption of food that has been improperly cooked or stored (2 words)
10. A viral infection that causes swelling of the parotid salivary glands and is most likely to affect children between 5 and 15 years of age, but may occur at any age
12. Misalignment of teeth due to the positioning of the jaw, to alignment of individual teeth, or to missing teeth

DOWN

1. A sac that forms in a weak spot in the wall of a hollow organ
2. Inflammation of the liver caused by several different viruses, though the vast majority of cases are caused by one of three strains of viruses, leading to the designations A, B, and C
3. A condition caused by the inability to digest milk or milk products because of the body's inability to produce lactase (2 words)
5. A condition in which an organ is unable to process a substance, such as a type of food, that would normally be processed
8. Mechanical or functional obstruction of the intestine
11. Permanent damage to the enamel and often underlying layers of a tooth as a result of the chemical actions of acids produced by bacteria, particularly where food and plaque accumulate (2 words)

Crossword Puzzle 11—Terms from Objective 30 (cont.)

Name _____ Date _____



ACROSS

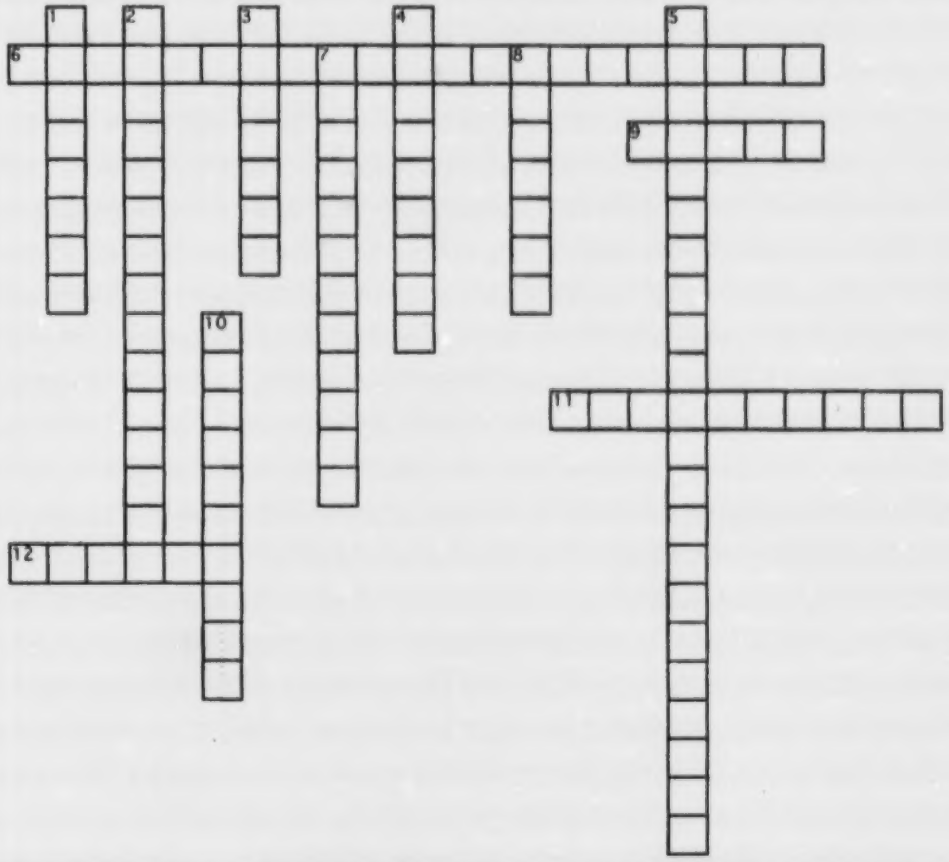
4. Vomiting
5. A sensation of burning behind the sternum and other symptoms as a result of gastric acids escaping into the esophagus that is often caused by excessive pressure on the cardiac sphincter or a weakening of that opening
6. Inflammation or infection of the gums in which the gums are swollen and red and bleed
8. An enlarged, abnormally dilated vein of the anal canal
13. A mental condition where one avoids food consumption due to psychological factors (2 words)

DOWN

1. Inflammation of the structures that attach the tooth to the bones of the jaw, which include the periodontal ligament, the gingiva, and the alveolar bone
2. The fibrous tissue that attaches the teeth to the alveoli (2 words)
3. A chronic inflammatory bowel disease usually affecting the ileum, the colon, or both structures (2 words)
7. Inflammation of the rectum and anus caused by infection, trauma, drugs, allergy, or radiation injury and characterized by rectal discomfort and the repeated urge to pass feces with the inability to do so
9. A condition of unusually infrequent and often difficult bowel movements that can be symptomatic of a number of diseases or conditions
10. An abnormal passageway that develops between the rectal wall and the skin, often in association with bowel diseases such as Crohn's disease (2 words)
11. A condition of unusually frequent and often watery or loose bowel movements that can be symptomatic of a number of diseases, conditions, and emotional states
12. A loss of appetite

Crossword Puzzle 12—Terms from Objective 30 (cont.)

Name _____ Date _____



ACROSS

6. Any of various conditions that result in the inability of the digestive system, especially the small intestine, to absorb nutrients (2 words)
9. _____ cancer is cancer of the liver
11. _____ cancer is cancer of the colon or rectal area
12. An urge to vomit or an unsettled feeling in the stomach that may also be associated with an aversion to food

DOWN

1. A condition in which bilirubin is eliminated through the bloodstream instead of through the feces, resulting in yellowish discoloration of the skin, mucous membranes, and eyes and often a grayish discoloration of the feces
2. Inflammation of the stomach and intestines that accompanies numerous disorders of the alimentary tract and is characterized by anorexia, nausea, vomiting, abdominal discomfort, and diarrhea
3. An inflammation of the large intestine characterized by severe diarrhea, bleeding, and ulceration of the mucosa of the intestine
4. A condition of liver deterioration marked by the buildup of scar tissue when damage to the liver occurs at a rate faster than the liver is able to repair itself
5. A condition often brought on by stress that results in diarrhea or constipation (3 words)
7. Inflammation of the pancreas, particularly as a result of blockage of the pancreatic duct
8. _____ cancer is cancer of the stomach
10. _____ cancer is cancer of the pancreas

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. ORGANIC
8. DIGESTIVE SYSTEM
11. CARBOHYDRATE
12. CALORIE
13. MINERAL
14. LIPID
15. CELLULOSE

DOWN
2. ANUS
3. PROTEIN
4. VITAMIN
5. FECES
6. AMINO ACIDS
7. KILOGRAM CALORIES
9. INORGANIC
10. DEFECATION
16. URINATION

Crossword Puzzle 2

ACROSS
1. ACCESSORY GLANDS
5. PANCREAS
6. BILE
9. ALIMENTARY TRACT
11. ESOPHAGUS
12. PHARYNX

DOWN
2. SMALL INTESTINE
3. LIVER
4. LARGE INTESTINE
7. GALLBLADDER
8. STOMACH
10. MOUTH

Crossword Puzzle 3

ACROSS
3. UVULA
5. TEETH
7. PAROTID GLANDS
9. SUBMANDIBULAR
11. TONGUE

DOWN
1. MASTICATION
2. SUBLINGUAL
4. DEGLUTITION
6. HARD PALATE
8. SOFT PALATE
10. MOUTH

Crossword Puzzle 4

ACROSS
1. CUSPID
3. ALVEOLUS
6. INCISOR
7. PROCESS
10. MOLAR
12. PERIODONTAL
15. CROWN
17. GUMS
18. DECIDUOUS

DOWN
2. PULP CAVITY
3. ALVEOLAR PROCESSES
4. PERI
5. PREMOLAR
8. TRICUSPIDS
9. ROOT
11. NECK
13. ENAMEL
14. WISDOM TEETH
16. DENTIN

Crossword Puzzle 5

ACROSS
2. PYLORUS
4. PHARYNX
7. CHYME
8. HIATUS
10. OROPHARYNX
12. LESSER
14. ESOPHAGUS
17. CARDIAC
18. VOMITUS

DOWN
1. BODY
3. GREATER
5. NASOPHARYNX
6. LARYNGOPHARYNX
9. PERISTALSIS
11. PYLORIC
13. FUNDUS
15. PERITONEAL
16. SPHINCTER

Crossword Puzzle 6

ACROSS
3. JEJUNUM
5. PEPSIN
6. ILEOCECAL VALVE
7. STOMACH
9. GASTRIC PITS
11. MUCUS

DOWN
1. LACTEAL
2. DUODENUM
4. VILLI
5. PEPSINOGEN
8. MUCOSA
10. ILEUM

Crossword Puzzle 7

ACROSS
2. VERMIFORM
5. ANAL CANAL
6. APPENDIX
8. HEPATIC FLEXURE
9. CECUM
10. SIGMOID COLON
11. DESCENDING COLON

DOWN
1. COLON
2. VERMIFORM APPENDIX
3. RECTUM
4. TRANSVERSE COLON
5. ASCENDING COLON
7. SPLENIC FLEXURE

Crossword Puzzle 8

ACROSS
2. FALCIFORM LIGAMENT
8. HAUSTRA
12. CAUDATE
14. HYPOGLYCEMIA

DOWN
1. RIGHT LOBE
3. LEFT LOBE
4. ISLANDS OF LANGERHANS
5. LIVER
6. GLISSONS CAPSULE
7. QUADATE
9. BILIRUBIN
10. KUPFFER CELLS
11. FALCIFORM
13. CHOLESTEROL

Crossword Puzzle 9

ACROSS
2. PYLORIC
5. STENOSIS
7. GASTRIC
10. PERITONITIS
11. BILIARY CALCULUS
12. APPENDECTOMY

DOWN
1. GASTRIC ULCER
2. PYLORIC STENOSIS
3. CALCULUS
4. BILIARY
6. DUODENAL ULCER
8. DIVERTICULOSIS
9. APPENDICITIS

Crossword Puzzle 10

ACROSS
1. DIVERTICULA
4. DIVERTICULITIS
6. PARALYTIC
7. PARALYTIC ILEUS
9. FOOD POISONING
10. MUMPS
12. MALOCCLUSION

DOWN
1. DIVERTICULUM
2. HEPATITIS
3. LACTOSE INTOLERANCE
5. INTOLERANCE
8. ILEUS
11. TOOTH DECAY

Crossword Puzzle 11

ACROSS
4. EMESIS
5. HEARTBURN
6. GINGIVITIS
8. HEMORRHOID
13. ANOREXIA NERVOSA

DOWN
1. PERIODONTITIS
2. PERIODONTAL LIGAMENT
3. CROHNS DISEASE
7. PROCTITIS
9. CONSTIPATION
10. ANAL FISTULA
11. DIARRHEA
12. ANOREXIA

Crossword Puzzle 12

ACROSS

6. MALABSORPTION SYNDROME
9. LIVER
11. COLORECTAL
12. NAUSEA

DOWN

1. JAUNDICE
2. GASTROENTERITIS
3. COLITIS
4. CIRRHOSIS
5. IRRITABLE BOWEL SYNDROME
7. PANCREATITIS
8. STOMACH
10. PANCREATIC

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 14

1. The _____ is located in the middle portion of the throat behind the mouth between the palate and the hyoid bone.

   a. laryngopharynx

   b. nasopharynx

   c. esophopharynx

   d. oropharynx

Objective 30

2. _____ is any of various conditions that result from the introduction of pathogens or pathogenic toxins through the consumption of food that has been improperly cooked or stored.

   a. Toxic shock syndrome

   b. Food poisoning

   c. Food intolerance

   d. Pathogenic contamination

Objective 2

3. The digestive system converts nutrients into _____ at the cellular level.

   a. proteins

   b. fat

   c. carbohydrates

   d. energy

Objective 8

4. The roof of the mouth is formed by the _____.

   a. cheeks and lips

   b. hard and soft palates

   c. nasopharyngeal cavities

   d. none of the above

Objective 30

5. Pancreatitis is often the result of _____.

   a. liver deterioration

   b. blockage of the pancreatic duct

   c. multiple sclerosis

   d. excessive bile secretions by the liver

Objective 3

6. The _____ is the digestive tube—the muscular tube that extends from the mouth to the anus.

   a. alimentary tract

   b. digestive system

   c. large intestine

   d. small intestine

Objective 25

7. The _____ lobe of the liver constitutes approximately 80 percent of the total mass of the liver.

   a. right

   b. left

   c. quadate

   d. caudate

Objective 15

8. The top portion of the esophagus has no _____ as it lies in the thoracic cavity.

   a. opening

   b. peritoneal coat

   c. muscle

   d. movement

Objective 5

9. The _____ secrete the digestive enzymes that are used by the digestive system to break down food substances in preparation for absorption into the bloodstream.

   a. intestines

   b. pharynx and esophagus

   c. esophagus and stomach

   d. accessory glands

Objective 30

10. An enlarged, abnormally dilated vein of the anal canal is referred to as _____.

    a. an *anal fissure*

    b. an *anal fistula*

    c. a *hemorrhoid*

    d. *irritable bowel syndrome*

Objective 25

11. The _____ ligament is formed by folds of peritoneum, dividing the liver into left and right lobes.

    a. coronary

    b. lateral

    c. falciform

    d. round

Objective 6

12. The _____ is the pear-shaped gland on the surface of the liver that serves as a reservoir for bile.

    a. stomach

    b. pancreas

    c. liver

    d. gallbladder

Objective 19

13. The _____ is the upper part of the small intestine.

    a. duodenum

    b. jejunum

    c. ileum

    d. ileoceca

Objective 8

14. The soft palate is composed of _____.

    a. mucous membrane

    b. muscular fibers

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 30

15. _____ is an urge to vomit or an unsettled feeling in the stomach that may also be associated with an aversion to food.

    a. Emesis
    b. Anorexia
    c. Nausea
    d. Bulimia

Objective 10

16. Within the center portion of a tooth, nerves and blood vessels are encased in a softer tissue referred to as the _____.

    a. *pulp*
    b. *dentin*
    c. *enamel*
    d. *crown*

Objective 8

17. Most of the floor of the mouth is formed by the _____.

    a. hard palate
    b. soft palate
    c. tongue
    d. periosteum

Objective 2

18. The digestive system converts excess nutrients into _____ for later use.

    a. proteins
    b. fat
    c. carbohydrates
    d. energy

Objective 30

19. A mechanical or functional obstruction of the intestine is _____.

    a. an emesis
    b. a stenosis
    c. a diverticula
    d. an ileus

Objective 22

20. The _____ colon curves downward in an S-shape to join the rectum.

a. ascending

b. sigmoid

c. transverse

d. descending

Objective 10

21. The teeth are set in sockets called _____.

a. *alveolar processes*

b. *uvular processes*

c. *gingivalar processes*

d. *root sockets*

Objective 8

22. The _____ is the conical structure that hangs from the posterior border of the soft palate.

a. uvula

b. tonsil

c. alveolus

d. gingiva

Objective 30

23. _____ is a sensation of burning behind the sternum and other symptoms as a result of gastric acids escaping into the esophagus.

a. Proctitis

b. Nausea

c. Emesis

d. Heartburn

Objective 27

24. Which of the following is NOT a correct characteristic of the pancreas?

a. 6 to 9 inches long

b. 1 to 1½ inches in width

c. 3 inches thick

d. weighs 2 to 3 ounces

Objective 12

25. The _____ are four pointed teeth at the sides and toward the front of the mouth and are adapted for biting and tearing food.

    a. incisors

    b. cuspids

    c. bicuspids

    d. tricuspids

Objective 16

26. The _____ sphincter is the opening that is located at the upper end of the stomach, where the esophagus joins the stomach.

    a. fundus

    b. pyloric

    c. chyme

    d. cardiac

Objective 30

27. The presence of pouch-like hernations through the muscular layer of the colon—particularly in the sigmoid colon—are referred to as _____.

    a. *diverticulosis*

    b. *diverticulitis*

    c. *cholelithiasis*

    d. *a perforated colon*

Objective 1

28. The _____ is the organs, structures, and accessory glands of the digestive tube of the body through which food passes from the mouth to the anus.

    a. anus

    b. alimentary tract

    c. digestive system

    d. large intestine

Objectives 4 & 15

29. The esophagus is a muscular, collapsible tube about _____.

    a. 10 inches long from the pharynx to the stomach

    b. 20 inches long from the pharynx to the stomach

    c. 10 inches long from the mouth to the stomach

    d. 20 inches long from the mouth to the stomach

Objective 4

30. The _____ is the longest portion of the alimentary tract.

a. pharynx

b. larynx

c. large intestine

d. small intestine

Objective 12

31. Which teeth are located in the posterior section of the mouth and are adapted for crushing food?

a. incisors

b. cuspids

c. premolars

d. molars

Objective 15

32. The esophagus goes through the esophageal hiatus in the _____ in its descent from the thoracic cavity to the abdominal cavity.

a. liver

b. pancreas

c. stomach

d. diaphragm

Objective 27

33. The pancreatic duct and the common bile duct unite to form the _____.

a. ampulla of Vater

b. duct of Wirsung

c. common hepatic duct

d. sphincter of Oddi

Objective 30

34. _____ is a viral infection that causes swelling of the parotid salivary glands.

a. Hepatitis

b. Mumps

c. Gingivitis

d. Periodontitis

Objective 16

35. The _____ is the lower portion of the stomach.

a. fundus

b. body

c. pylorus

d. small intestine

Objective 12

36. Which teeth are adapted for grinding food?

a. incisors

b. cuspids

c. premolars

d. molars

Objective 18

37. Which of the following is NOT a true statement about the stomach?

a. The mucosa of the stomach contains gastric pits.

b. The gastric juice pepsin converts into pepsinogen in the presence of HCL.

c. The stomach can hold up to 2 quarts of food until the chyme is ready to be received into the small intestine.

d. The stomach collapses and distends, according to the amount of food within it.

Objective 30

38. _____ is a condition of unusually frequent and often watery or loose bowel movements that can be symptomatic of a number of diseases, conditions, and emotional states.

a. Diarrhea

b. Constipation

c. Nausea

d. Anorexia

Objective 22

39. The _____ flexure of the colon is located at the abrupt bend of the ascending colon.

a. hepatic

b. splenic

c. pyloric

d. cardiac

Objective 19

40. The _____ valve is between the ileum and the cecum and prevents feces from backing into the ileum.

a. pyloric

b. cardiac

c. lacteal

d. ileocecal

Objective 8

41. Which of the following is NOT a major structure of the mouth?

a. tongue

b. hard palate

c. periodontal membrane

d. salivary gland

Objective 20

42. The rugae and villi of the small intestine _____.

a. prevent chyme from passing through the intestine too quickly

b. increase the surface area of the small intestine

c. both "a" and "b"

d. neither "a" nor "b"

Objective 22

43. The _____ colon is the portion of the colon that lies in a vertical position on the left side of the abdomen and extends from a point below the stomach to the level of the iliac crest.

a. ascending

b. sigmoid

c. transverse

d. descending

Objective 27

44. The special cells in the pancreas that are called the *islands of Langerhans* produce _____, which are absorbed directly into the blood vessels.

a. digestive enzymes

b. red bone cells

c. insulin and glucagon

d. glucose and lactose

Objective 21

45. The _____ is the portion of the large intestine that extends from the colon to the anal canal.

a. cecum

b. ascending colon

c. rectum

d. vermiform appendix

Objective 18

46. The mucosa of the stomach contains folds known as _____.

a. *villi*

b. *pylori*

c. *rugae*

d. *laminae*

Objective 10

47. There are 20 _____ teeth and 32 _____ teeth.

a. deciduous; permanent

b. permanent; deciduous

c. lower; upper

d. upper; lower

Objective 20

48. Throughout the small intestine, there are microscopic, velvety, finger-like projections known as _____.

a. *rugae*

b. *villi*

c. *cilia*

d. *ileum*

Objective 24

49. The large intestine has no _____.

a. villi

b. mucous lining

c. haustra

d. bands of muscle

Objective 30

50. An ulcer of the stomach lining is called a _____ *ulcer.*

a. *gastric*

b. *duodenal*

c. *pyloric*

d. *mocosan*

Objective 26

51. Which of the following is NOT a function of the liver?

a. produces bile

b. stores glycogen, iron, and certain vitamins

c. converts excess water into urine

d. changes proteins into urea

Objective 4

52. The _____ is the tubular structure that extends from the base of the skull to the esophagus.

a. mouth

b. pharynx

c. larynx

d. alimentary tract

Objective 24

53. The large intestine does not secrete _____ but does secrete _____.

a. mucus; enzymes

b. enzymes; mucus

c. pepsin; pepsinogen

d. pepsinogen; pepsin

Objective 30

54. Inflammation of the stomach and intestines that accompanies numerous disorders of the alimentary tract and is characterized by anorexia, nausea, vomiting, abdominal discomfort, and diarrhea is referred to as _____.

a. *colitis*

b. *cirrhosis*

c. *proctitis*

d. *gastroenteritis*

Objective 26

55. Which of the following is NOT a function of the liver?

a. manufactures antigens

b. produces body heat

c. detoxifies harmful substances, such as drugs and poisons, before they make their way to the heart

d. manufactures cholesterol

Objective 25

56. Which of the following is NOT a correct statement about the liver?

a. The liver is completely covered by Glisson's capsule.

b. The upper convex surface of the liver fits under the diaphragm.

c. The lower concave portion fits over the kidney, ascending colon, and pyloric end of the lower stomach.

d. The liver is the last organ to receive blood from the intestines after nutrient absorption.

Objective 6

57. The _____ is a fish-shaped gland that secretes digestive enzymes, insulin, and glucagon.

a. stomach

b. pancreas

c. liver

d. gallbladder

Objective 30

58. A gallstone is also called _____.

a. an *emesis*

b. a *stenosis*

c. a *biliary calculus*

d. a *diverticula*

Objective 25

59. The common hepatic duct of the liver joins the _____ duct from the gallbladder to form the _____ duct.

a. bile; common cystic

b. cystic; common bile

c. hepatic; combined cystic

d. hepatic; combined bile

Objective 20

60. What is the term for and purpose of the lymph channels found in the projections of the small intestine?

a. villi, the digestion of carbohydrates

b. rugae, the break down of carbohydrates

c. lacteal, the absorption of fats

d. cilia, the reduction of lipids

Objective 28

61. The gallbladder is about 3 to 4 inches long and 1 inch wide, and it holds about _____.

a. 6 cc of pancreatic juice

b. 36 cc of pancreatic juice

c. 6 cc of bile

d. 36 cc of bile

Objective 15

62. Food is propelled from the esophagus into the stomach by _____.

a. gravity

b. peristalsis

c. salivary lubricants

d. the low pressure in the stomach

Objective 25

63. Small bile ducts within the liver join to form two larger ducts that emerge from under the concave surface of the liver as the _____ ducts and immediately join to form the _____ duct.

a. inferior and superior cystic; combined cystic

b. inferior and superior hepatic; combined hepatic

c. right and left cystic; common cystic

d. right and left hepatic; common hepatic

Objective 30

64. Loss of peristaltic movement in the intestine is called _____.

a. *constipation*

b. *paralytic colon*

c. *paralytic ileus*

d. *malocclusion*

Objective 27

65. The pancreas has special cells called _____ that lie in clusters between the pancreatic cells and are scattered throughout its structure.

a. *pancreatic glands*

b. *Langerhan cells*

c. *inlets of pancreatic enzymes*

d. *islands of Langerhans*

Objective 25

66. The _____ duct of the liver opens into the duodenum at an enlargement called the _____.

a. common bile; *ampulla of Vater*

b. common hepatic; *sphincter of Oddi*

c. common hepatic; *ampulla of Vater*

d. common bile; *sphincter of Vater*

Objective 28

67. Which of the following is NOT one of the layers of the gallbladder?

a. mucous membrane

b. muscular and fiber tissue

c. connective tissue

d. serous membrane

Objective 24

68. The mucous lining of the large intestine contains _____.

a. vast networks of lymph nodes

b. intestinal glands and solitary lymph nodes

c. solitary intestinal glands

d. villi and intestinal glands

Objective 27

69. Which of the following is NOT a correct statement with regard to the pancreas?

a. The head of the pancreas fills the C-curve of the duodenum, to which it is firmly attached.

b. The body of the pancreas extends horizontally across the posterior abdominal wall.

c. The tail of the pancreas touches the spleen.

d. The pancreas is about the same size in adults regardless of the sex or age of the person.

Objective 10

70. The three major sections of a tooth are the _____.

a. root, neck, and crown

b. foot, body, and head

c. root, body, and crown

d. root, neck, and head

Objective 27

71. Special cells of the pancreas manufacture pancreatic juice, which is carried by the pancreatic duct to the _____.

a. liver

b. duodenum

c. stomach

d. jejunum

Objective 30

72. Abnormal narrowing of the pyloric opening is called _____.

a. *pyloric fissure*

b. *pyloric stenosis*

c. *pyloric ulceration*

d. *duodenal obstruction*

Objective 28

73. Bile is forced into the duodenum by contractions of _____ muscles in the walls of the _____.

a. involuntary; gallbladder and bile ducts

b. involuntary; left and right lobes of the liver

c. voluntary; gallbladder and bile ducts

d. voluntary; left and right lobes of the liver

Objective 30

74. _____ is an inflammation of the peritoneum.

a. Appendicitis

b. Parietalitis

c. Peristalsis

d. Peritonitis

Objective 2

75. One of the functions of the digestive system is to convert complex organic-compound molecules of ingested food into _____.

a. carbohydrates

b. simple organic and inorganic compounds

c. proteins

d. lipids and protolipids

Objective 30

76. Tooth decay is _____.

a. permanent damage to the enamel and often underlying layers of a tooth as a result of the chemical actions of acids produced by bacteria

b. misalignment of teeth due to positioning of the jaw, alignment of individual teeth, or missing teeth

c. inflammation or infection of the gums

d. inflammation of the structures that attach the tooth to the bones of the jaw

Objective 6

77. The _____ is the largest gland of the body.

a. stomach

b. pancreas

c. liver

d. gallbladder

Objective 30

78. _____ is a condition in which bilirubin is eliminated through the bloodstream instead of through the feces.

a. Jaundice

b. Malabsorption

c. Irritable-bowel syndrome

d. Cirrhosis

Objective 2

79. The digestive system eliminates _____.

a. by-products of digestion that are not used by the cells or stored

b. fat

c. pathogens that enter the body through the mouth

d. the need to eat continuously

Objective 8

80. When the _____ rises in swallowing, it separates the nasal cavity and the nasopharynx from the posterior part of the mouth and the oral portion of the pharynx.

a. mucous membrane

b. tongue

c. soft palate

d. hard palate

Objective 30

81. _____ is a condition of unusually infrequent and often difficult bowel movements that can be symptomatic of a number of diseases or conditions.

a. Diarrhea

b. Constipation

c. Irritable-bowel syndrome

d. Pyloric stenosos

Objective 8

82. The parotid glands secrete _____.

a. serous fluid only

b. serous fluid with some mucus

c. thick mucus with some amylase

d. watery serous fluid and amylase

Objective 30

83. _____ is an inflammation of the structures that attach the tooth to the bones of the jaw.

a. Gingivitis

b. Malocclusion

c. Periodontitis

d. Proctitis

Objective 7

84. The structure indicated by the letter "V" in the illustration on the next page is the _____.

a. stomach
b. pharynx
c. esophagus
d. pancreas

Objective 7

85. The structure indicated by the letter "W" in the illustration on the next page is the _____.

a. stomach
b. pharynx
c. esophagus
d. pancreas

Objective 7

86. The structure indicated by the letter "X" in the illustration on the next page is the _____.

a. gallbladder
b. small intestine
c. liver
d. large intestine

Objective 7

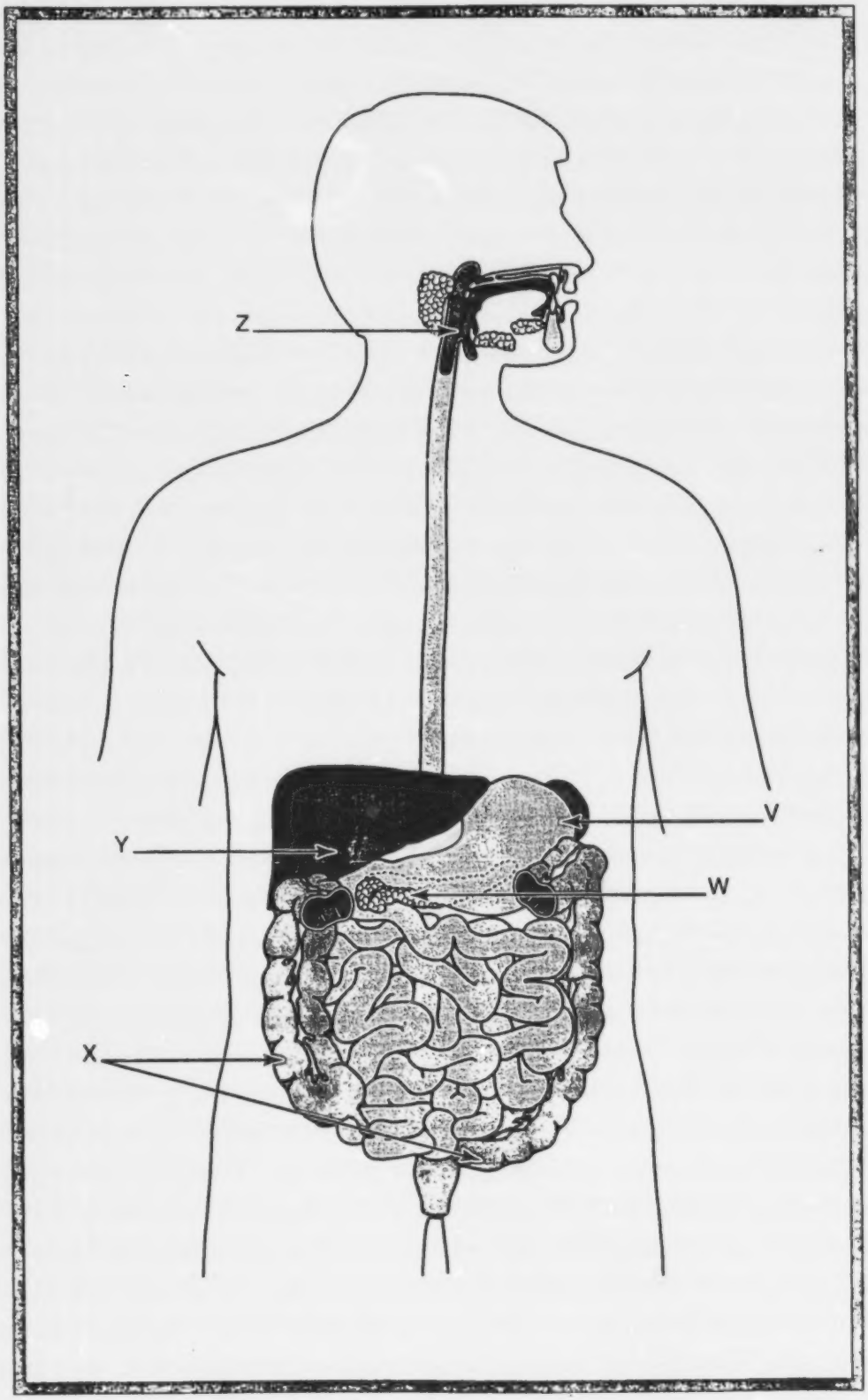
87. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

a. gallbladder
b. small intestine
c. liver
d. large intestine

Objective 7

88. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

a. stomach
b. pharynx
c. esophagus
d. pancreas


Z
Y
V
W
X

Objective 9

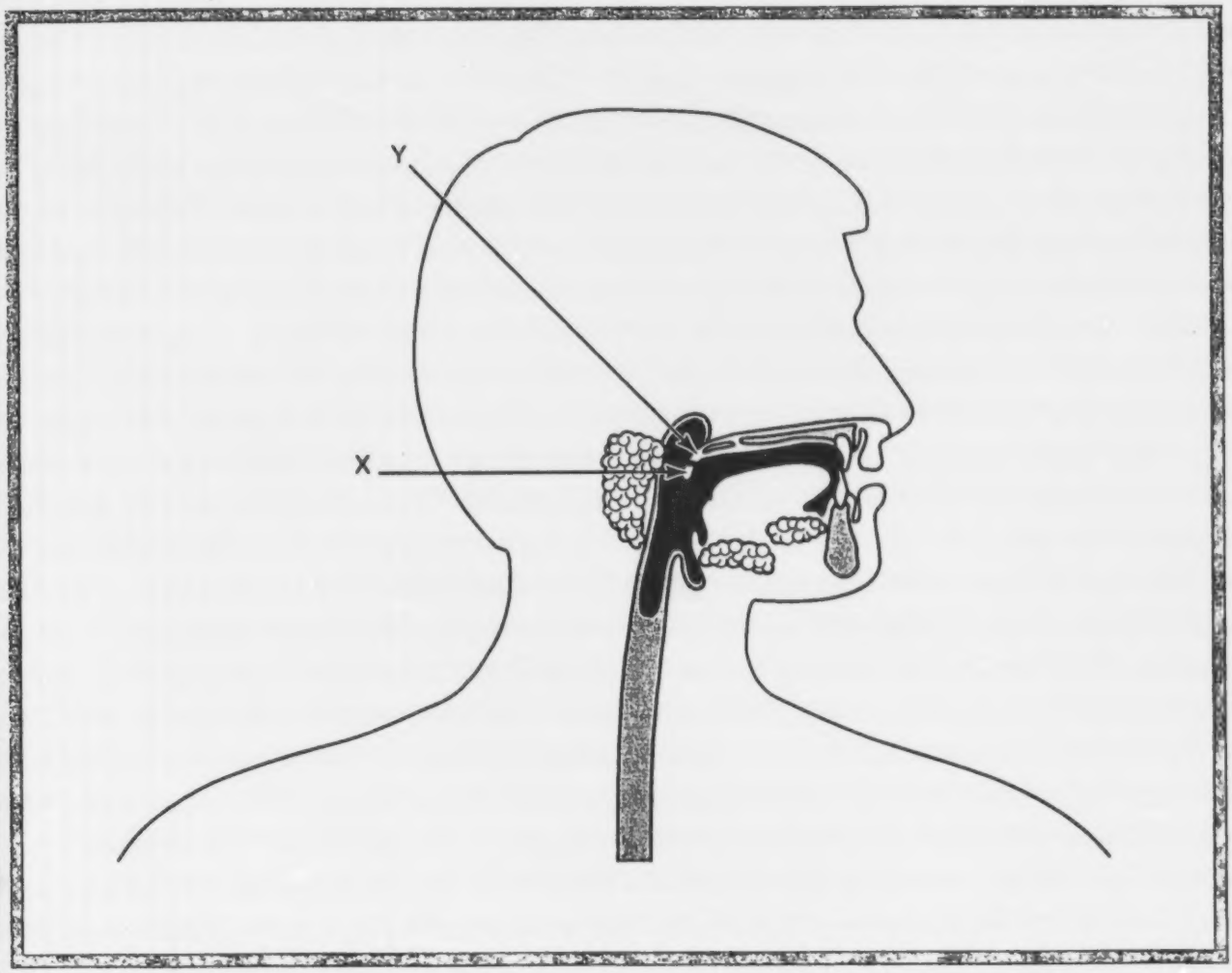
89. The structure indicated by the letter "X" in the illustration below is the _____.

a. soft palate

b. hard palate

c. uvula

d. salivary gland



Objective 9

90. The structure indicated by the letter "Y" in the illustration above is the _____.

a. soft palate

b. hard palate

c. uvula

d. salivary gland

Objective 11

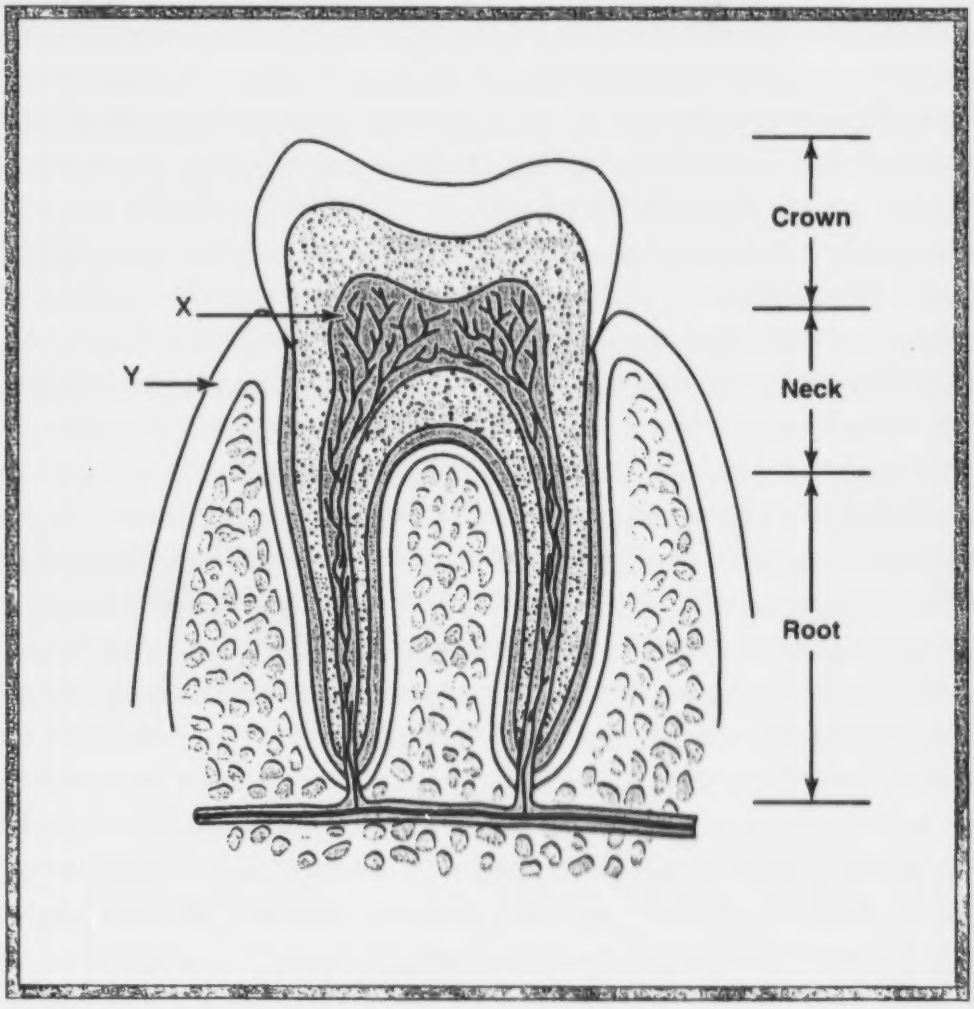
91. The structure indicated by the letter "X" in the illustration below is the _____.

a. enamel

b. pulp cavity

c. dentin

d. gingiva



Objective 11

92. The structure indicated by the letter "Y" in the illustration above is the _____.

a. enamel

b. pulp cavity

c. dentin

d. gingiva

Objective 13

93. The teeth indicated by the letter "W" in the illustration on the next page are the _____.

a. lateral incisors
b. cuspids
c. first premolars
d. second premolars

Objective 13

94. The teeth indicated by the letter "X" in the illustration on the next page are the _____.

a. lateral incisors
b. cuspids
c. first premolars
d. second premolars

Objective 13

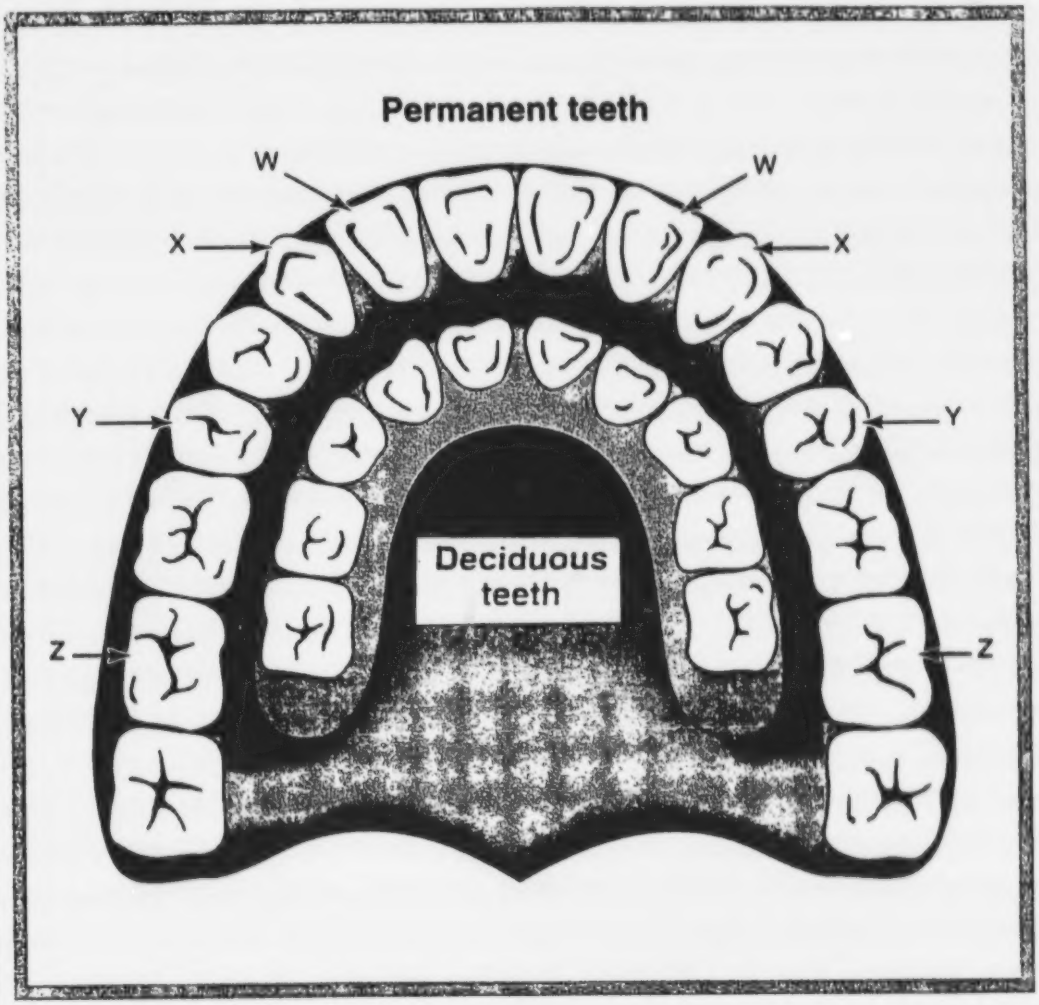
95. The teeth indicated by the letter "Y" in the illustration on the next page are the _____.

a. lateral incisors
b. second premolars
c. second molars
d. third molars

Objective 13

96. The teeth indicated by the letter "Z" in the illustration on the next page are the _____.

a. lateral incisors
b. second premolars
c. second molars
d. third molars



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Objective 17

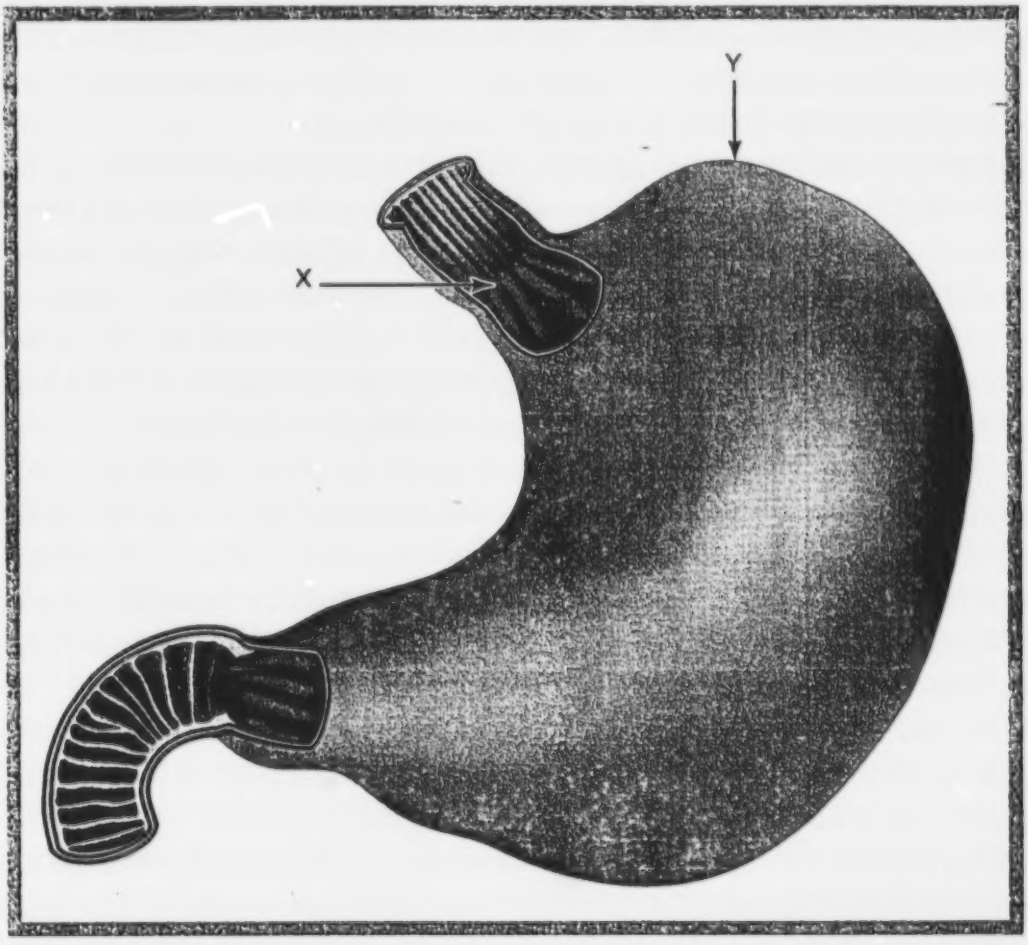
97. The structure indicated by the letter "X" in the illustration below is the _____ of the stomach.

a. cardiac sphincter

b. pyloric sphincter

c. fundus

d. pylorus



Objective 17

98. The structure indicated by the letter "Y" in the illustration above is the _____ of the stomach.

a. fundus

b. body

c. pylorus

d. cardiac sphincter

Objective 23

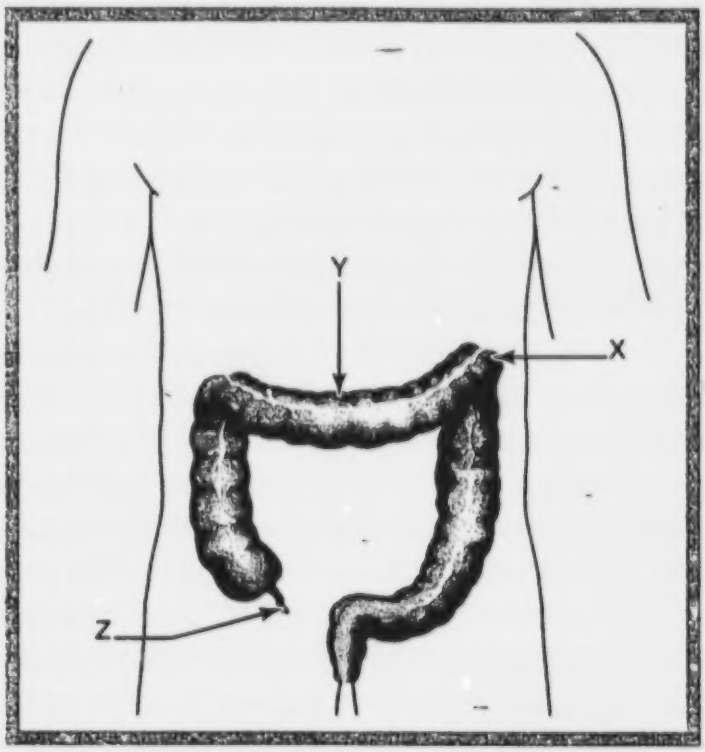
99. The structure indicated by the letter "X" in the illustration below is the _____ of the large intestine.

a. hepatic flexure

b. splenic flexure

c. pyloric flexure

d. cardiac flexure



Objective 23

100. The structure indicated by the letter "Y" in the illustration above is the _____ of the large intestine.

a. ascending colon

b. transverse colon

c. descending colon

d. sigmoid colon

Objective 23

101. The structure indicated by the letter "Z" in the illustration above is the _____ of the large intestine.

a. anal canal

b. vermiform appendix

c. cecum

d. rectum

Objective 29

102. The structure indicated by the letter "W" in the illustration on the next page is the _____.

a. right lobe of the liver
b. gallbladder
c. pancreas
d. left lobe of the liver

Objective 29

103. The structure indicated by the letter "X" in the illustration on the next page is the _____.

a. cystic duct
b. liver
c. gallbladder
d. duodenum

Objective 29

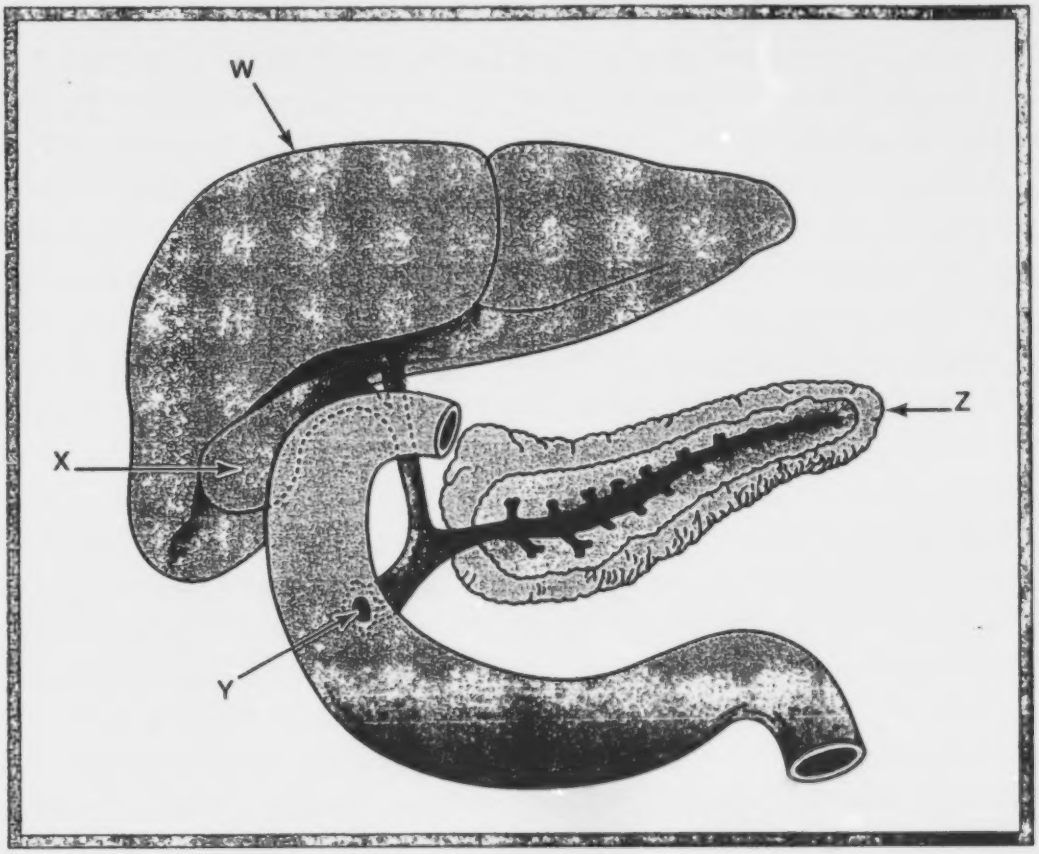
104. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

a. common bile duct
b. sphincter of Oddi
c. cystic duct
d. duodenum

Objective 29

105. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

a. left lobe of the liver
b. gallbladder
c. right lobe of the liver
d. pancreas


W
X
Y
Z

Answers to Module Review

1. d	22. a	43. d	64. c	85. d
2. b	23. d	44. c	65. d	86. d
3. d	24. c	45. c	66. a	87. a
4. b	25. b	46. c	67. c	88. b
5. b	26. d	47. a	68. b	89. c
6. a	27. a	48. b	69. d	90. a
7. a	28. c	49. a	70. a	91. b
8. b	29. a	50. a	71. b	92. d
9. d	30. d	51. c	72. b	93. a
10. c	31. d	52. b	73. a	94. b
11. c	32. d	53. b	74. d	95. b
12. d	33. a	54. d	75. b	96. c
13. a	34. b	55. a	76. a	97. a
14. c	35. c	56. d	77. c	98. a
15. c	36. c	57. b	78. a	99. b
16. a	37. b	58. c	79. a	100. b
17. c	38. a	59. b	80. c	101. b
18. b	39. a	60. c	81. b	102. a
19. d	40. d	61. d	82. d	103. c
20. b	41. c	62. b	83. c	104. b
21. a	42. c	63. d	84. a	105. d

MODULE SET II:
Major Body Systems

Module 13: Urinary System

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Urinary System	7
2—Major Organs and Structures of the Urinary System	9
3—Major Internal Macroscopic Structures of a Kidney	11
4—Major Microscopic Structures of a Nephron	13
5—Trigone Area of the Urinary Bladder	15
Written Test	17
Answers to Written Test	29
Answers to Assignment Sheet	33
Crossword Puzzles	
1—Terms from Objectives 1 Through 5	35
2—Terms from Objectives 6 Through 10	37
3—Terms from Objectives 12 and 13	39
4—Terms from Objectives 15 Through 19	41
5—Terms from Objective 19 (cont.)	43
Answers to Crossword Puzzles	45
Module Review	47
Answers to Module Review	63

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activity Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** The final three modules in this course deal with the urinary system and the two reproductive systems. Obviously, there is some overlap in the anatomical structures involved. Depending on the structure of your curriculum, you may choose to divide the objectives differently. For example, you may concentrate on the kidneys and urine production as part of this module but combine the objectives on urination and the respective anatomical differences in the genders for the modules on reproduction.

- Use crossword puzzles 1 through 5 to help reinforce the terms in the associated objectives.
- Use the following strategies to supplement your discussion of Objective 1 and Objective 2.
  - — Introduce the unit by pouring a colored liquid through a filter paper that will remove the pigment. Explain the process of filtration and relate it to the urinary system. Discuss the importance of the urinary system as an indicator of health.
  - — Expand your discussion by reviewing the functions of the urinary system as listed in Objective 2. Elaborate on each, relating the functions to concepts and systems that the students have already studied.
- Use illustrations and models to discuss the major organs and structures of the urinary system as presented in Objective 3 and Objective 4. Emphasize the relationship of the kidneys and the circulatory system, including the exchange of wastes.
- Use the following strategies to supplement your discussion of Objective 5 through Objective 10, which deal with the kidneys.
  - — Use illustrations, models, and animal organs to discuss the kidneys. Emphasize the structure of the kidneys and the nephrons. Make sure that the students understand how the exchange of substances among the capillaries and tubules takes place. Use the series of objectives to reinforce the parts of the kidney and the roles of those parts.
  - — Discuss each of the roles of the kidneys. Discuss blood pressure and fluid and electrolyte balance. Visit a kidney-dialysis center and have personnel explain how the equipment works and its benefits. Discuss survival with one kidney. Invite a kidney transplant recipient or donor or both to discuss the procedure and life with one kidney.

- Use the following strategies to supplement your discussion of Objective 11 through Objective 14, which deal with the ureters, urinary bladder, and the male and female urethra.

  — Use artwork, models, and animal organs to illustrate your discussion of the ureters, urinary bladder, and urethra.

  — Trace the flow of urine through the components. Help the students to understand the relationship of these parts to other anatomical structures.

  — Help students to understand the differences between the urinary tracts in males and females.

- Use the following strategies to supplement your discussion of Objective 15 through Objective 17, which concern the processes for producing and expelling urine and abnormal constituents of urine.

  — Discuss the production of urine, emphasizing the normal constituents of urine and how they come to be part of the urine. Describe or have the students observe the procedures for monitoring intake and output for urinary functions and the reasons for such monitoring, especially as they relate to surgical procedures.

  — Allow the students to perform or observe urinalysis and discuss the importance and value of such tests. Have a lab technician or physician discuss urinalysis as a diagnostic tool. Perform urinalysis with added components such as albumin, glucose, hemoglobin, water, and salt.

  ✔ **NOTE:** While it may be tempting to use students to provide specimens for urinalysis, be sure to check the policies of your facility. This practice may represent a privacy violation and create suspicions among the students that the testing is to check for illegal substances.

  — Discuss normal processes of urine production and urination. Discuss reasons for bladder control problems and interventions. Discuss the use of diuretics and antidiuretics.

- To supplement your discussion of Objective 18, display illustrations of and actual calculi. Provide the students with X rays showing calculi and discuss the predisposing conditions for the formation of calculi.

- For Objective 19, discuss various disorders and abnormalities related to the urinary system. Use photographs of conditions such as gout and other aids to discuss these conditions. Invite patients with various urinary-system conditions to discuss their experiences.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified*, 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy*, 15th ed. New York: Gramery Books, 1977.

- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites have been selected due to the information that they provide about the urinary system. Other modules list sites specific to the systems and disorders presented in that module.

- http://www.a-better-way.com/systems/13_1.html

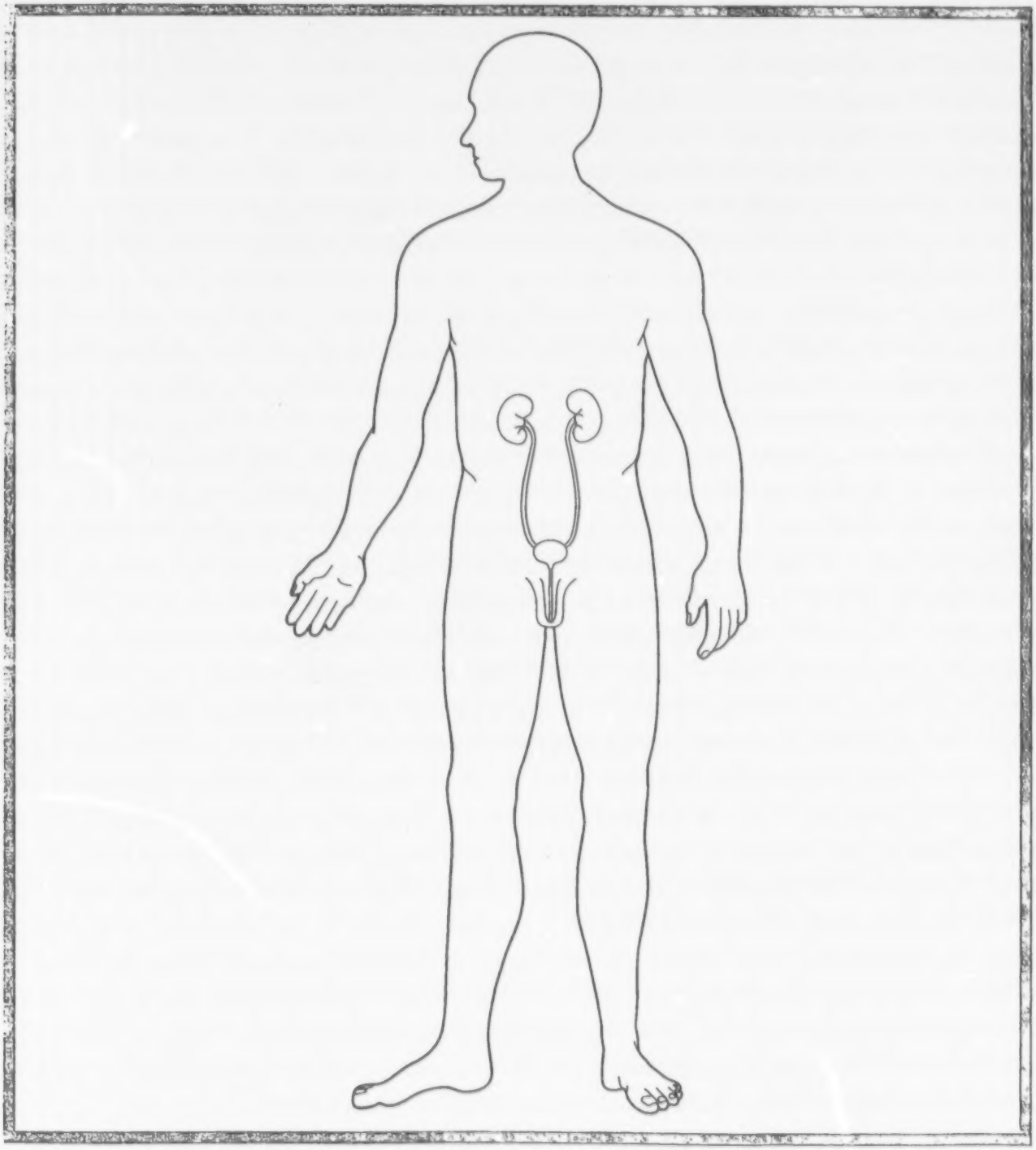
  Provides a good overview of the urinary systems for both males and females.

- http://www.idtonline.org/modules/brit-5/brit-5.htm

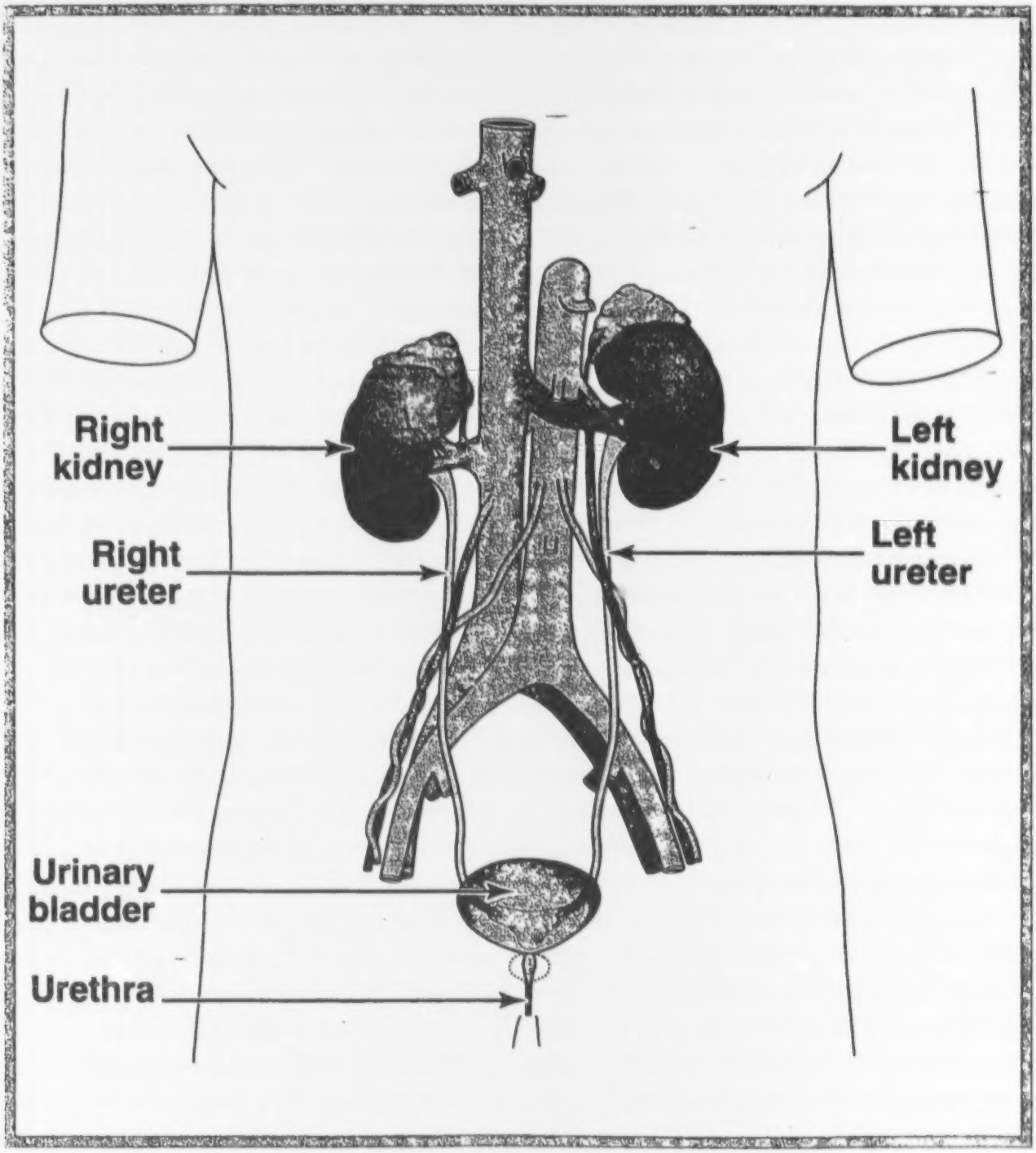
  Focuses on the female urinary system. Includes a complete lesson plan with pretest, instructional materials, and other components.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

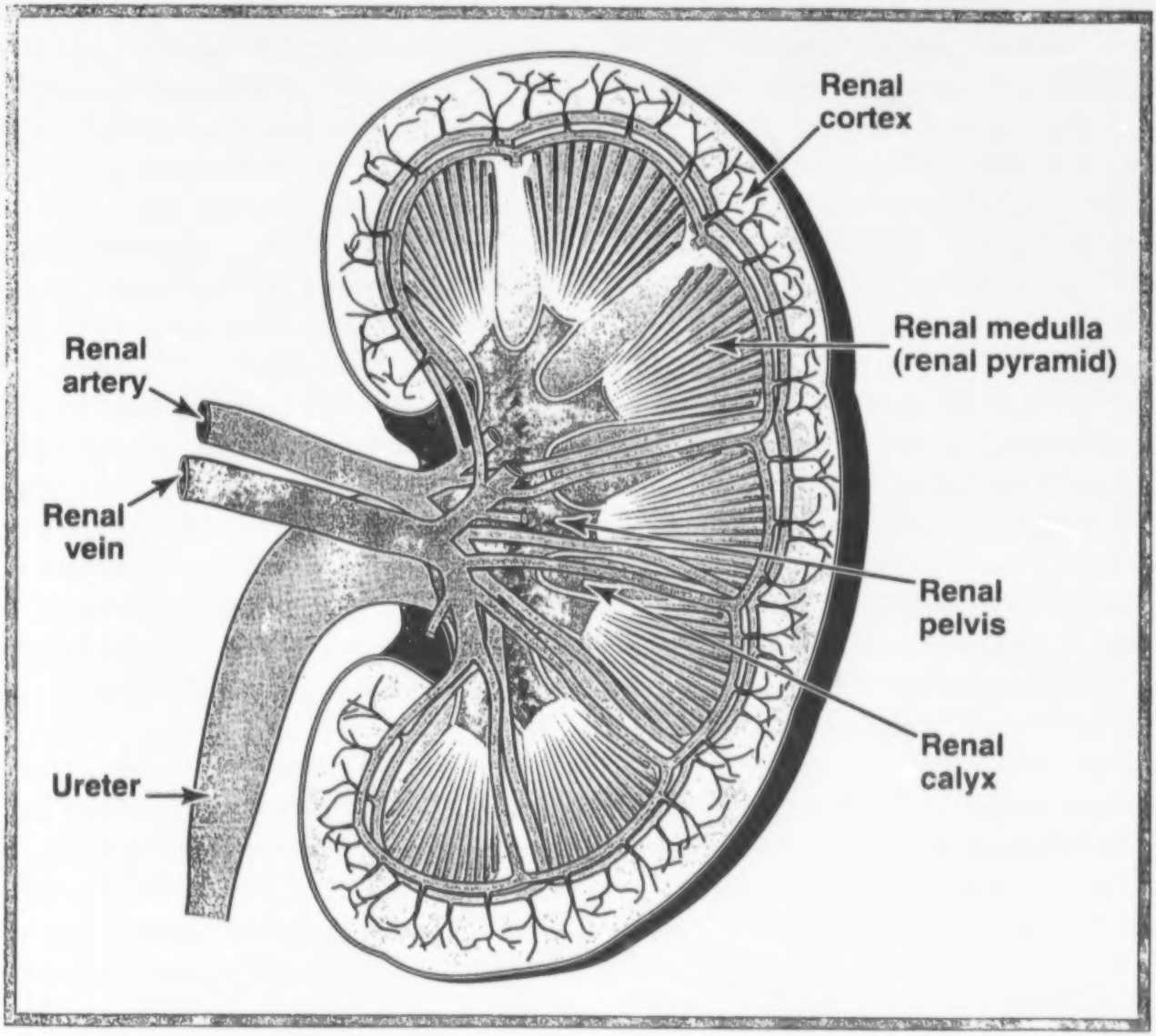
Urinary System



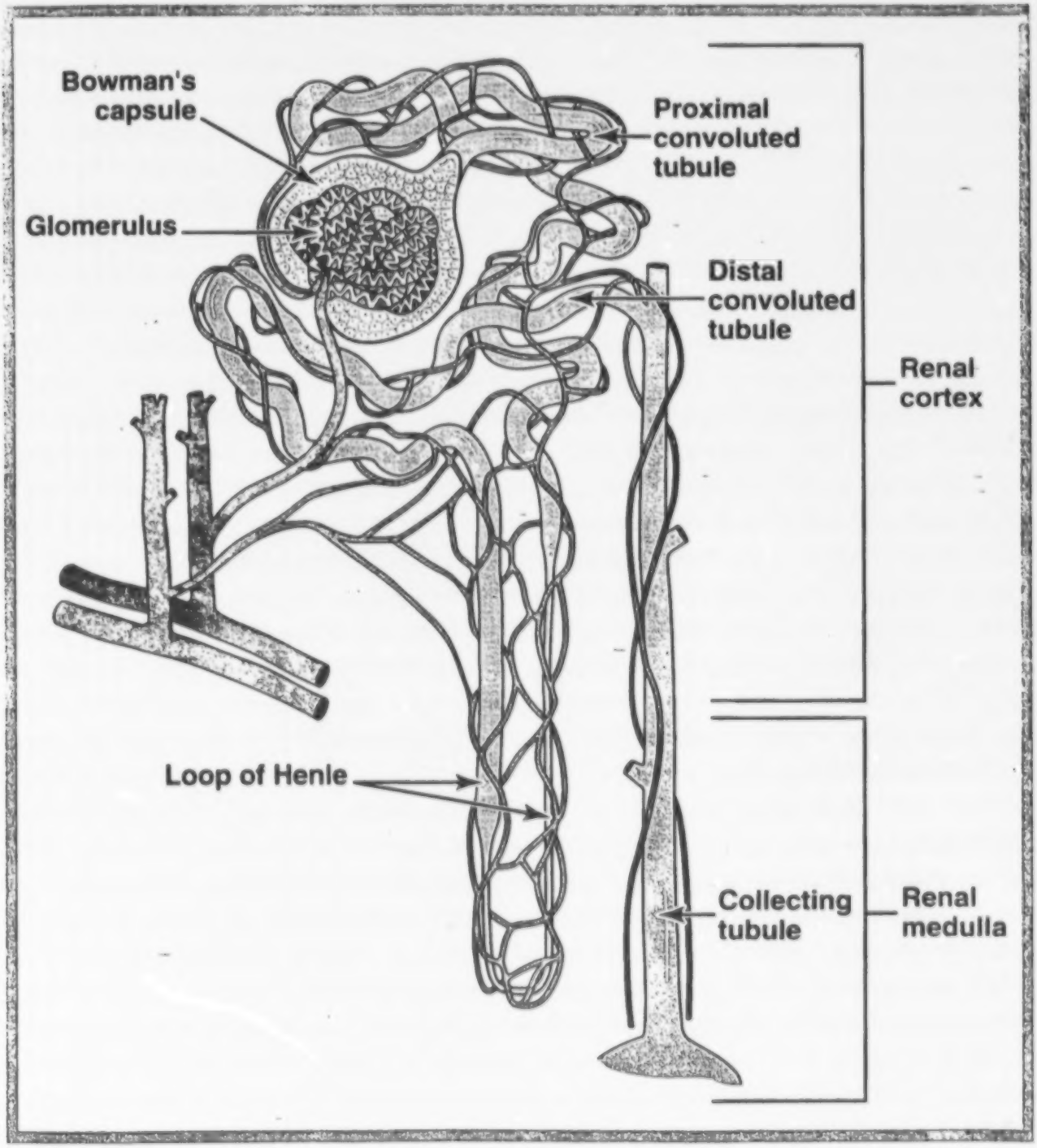
Major Organs and Structures of the Urinary System



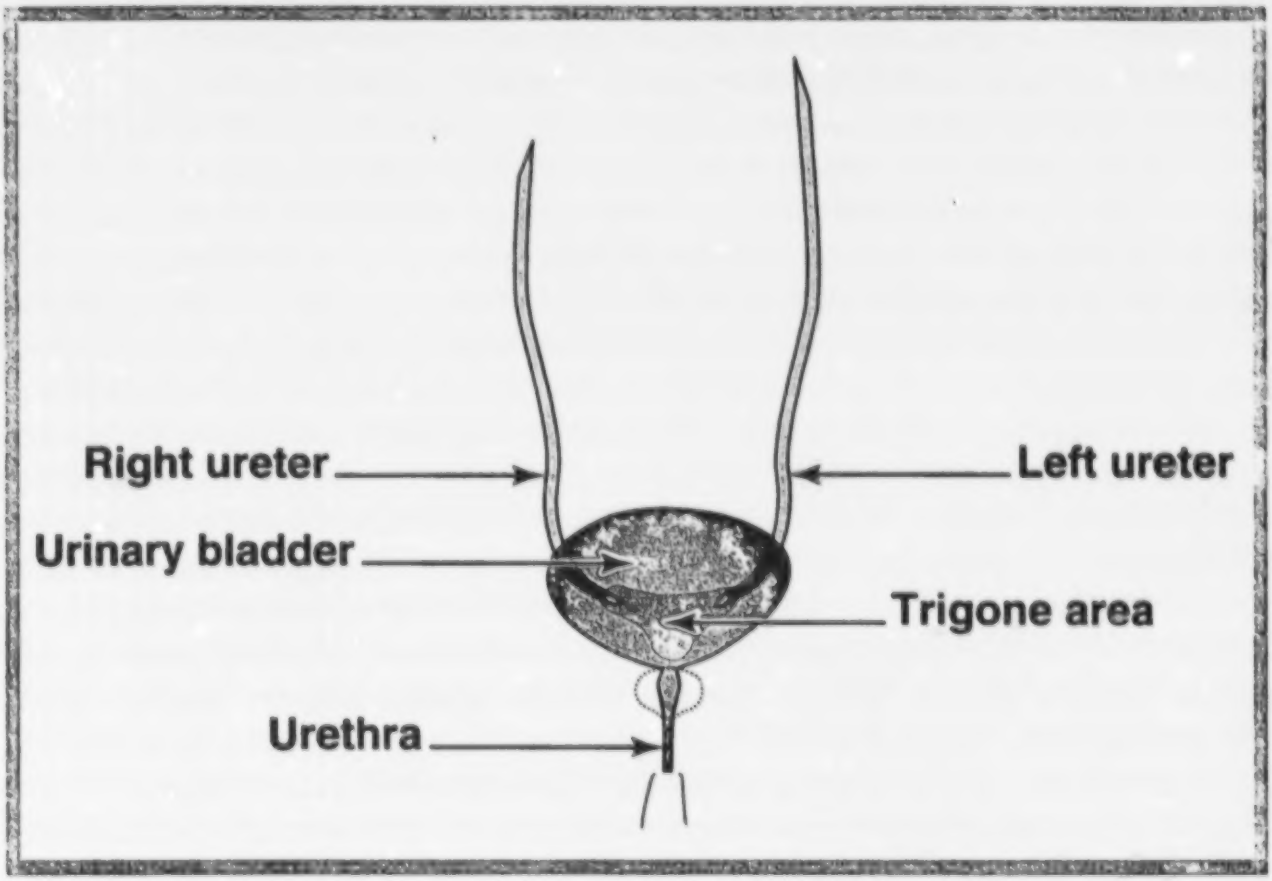
Major Internal Macroscopic Structures of a Kidney



Major Microscopic Structures of a Nephron



Trigone Area of the Urinary Bladder



Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *urinary system*. Write your answer on the blank lines provided beside the term below.

Urinary system _____

_____

_____

Objective 2 State the functions of the urinary system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

Objective 3 Define the major organs and structures of the urinary system. Write your answers on the blank lines provided beside each of the terms below.

a. Kidney _____

_____

b. Ureter _____

_____

c. Urinary bladder _____

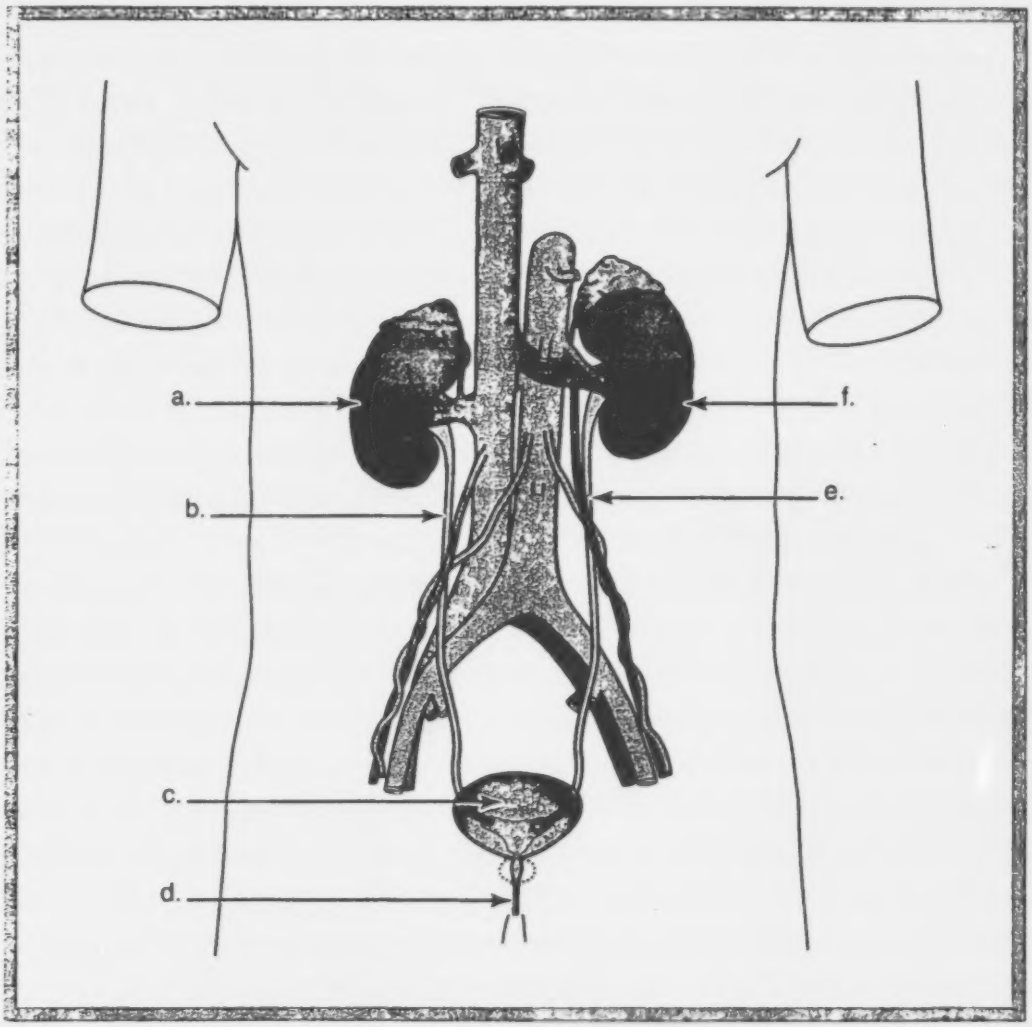
_____

d. Urethra _____

_____

OBJECTIVE 4

Label the major organs and structures of the urinary system. Write your answers on the blank lines provided below the following illustration.



a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

OBJECTIVE 5

Complete statements that describe the characteristics and external structure of the kidneys. Write your answers on the blank lines provided in the statements below and on the next page.

a. The kidneys lie behind the peritoneum, against the posterior wall of the _____.

b. Each kidney measures about 2½ by 4½ inches, but the _____ kidney is usually slightly larger than the _____ kidney.

c. The _____ kidney is usually a little lower than the _____ kidney because of the large space occupied by the liver.

d. Each kidney and its vessels are embedded in a pocket of fatty tissue called the _____, which protects the kidney from external blows and helps hold it in position.

e. The kidney and _____ are suspended in a web of fibrous tissue called the _____, which anchors the kidney to surrounding structures and also helps hold it in position.

f. The depression on the inner (medial) border of each kidney is called the _____.

g. The renal artery enters and the renal vein exits each kidney at the _____.

h. The renal artery carries blood containing waste products to _____ in the kidney that filter out the waste products.

i. Filtered blood leaves a kidney through the _____.

Objective 6 Define the major internal macroscopic structures of a kidney. Write your answers on the blank lines provided beside each of the terms below.

a. Renal cortex _____

_____

_____

b. Renal medulla _____

_____

_____

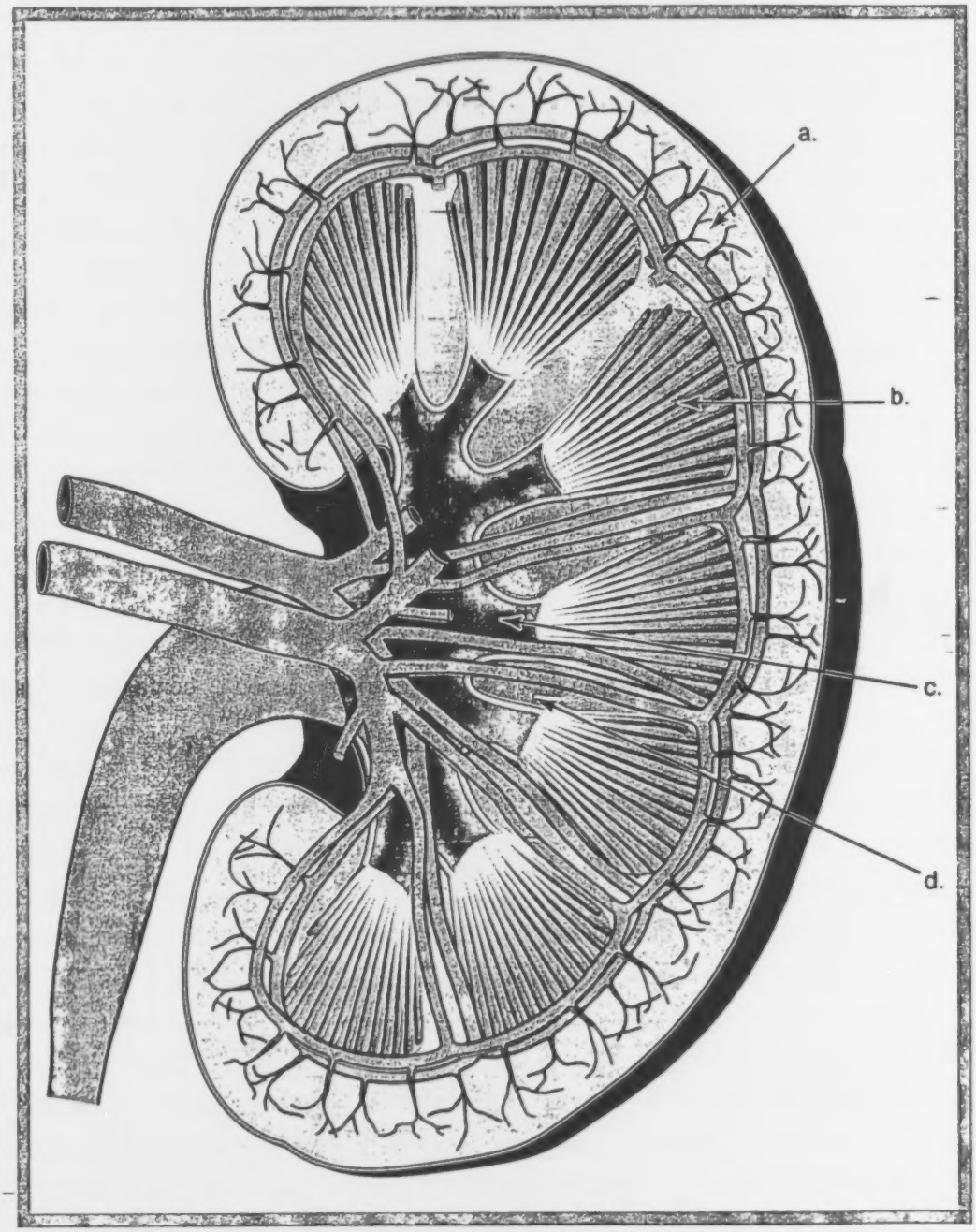
c. Renal pelvis _____

_____

_____

OBJECTIVE 7

Label the major internal macroscopic structures of a kidney. Write your answers on the blank lines provided below the following illustration.



a. _____ c. _____

b. _____ d. _____

Objective 8

Complete statements that describe the characteristics of the internal microscopic structures of a kidney. Write your answers on the blank lines provided in the statements below.

a. A nephron is one of the approximately 1 million funnel-shaped microscopic structures located along the interface of the _____ and the _____.

b. Each nephron consists of two major structures called the _____ and the _____.

c. A _____ consists of a glomerulus of renal capillaries enclosed within a funnel-shaped renal tubule called *Bowman's capsule*.

d. The _____ consists of four sections: (1) the proximal convoluted tubule, (2) the loop of Henle, (3) the distal convoluted tubule, and (4) the collecting tubule.

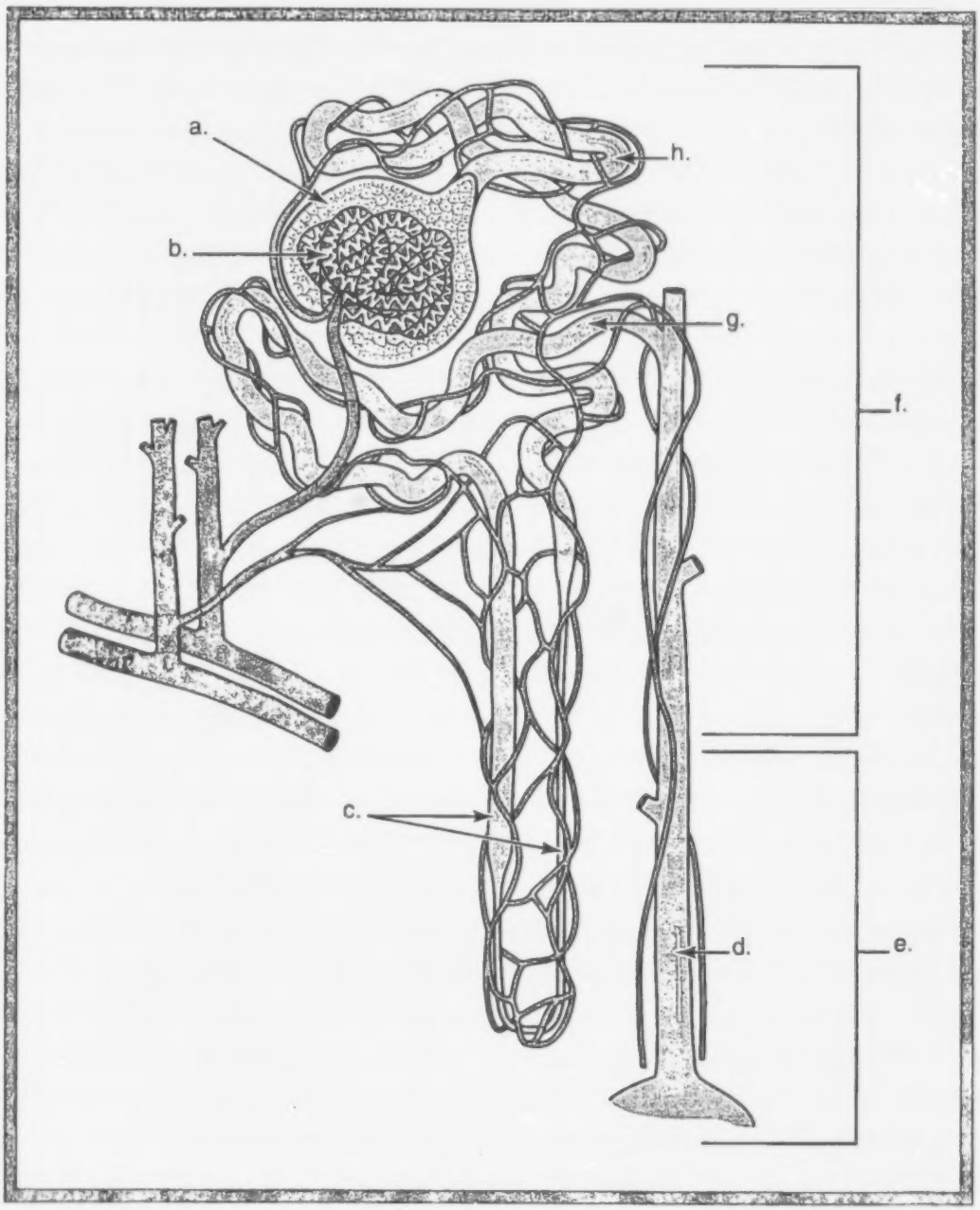
e. The renal corpuscles and the convoluted portions of the renal tubules are located in the _____.

f. The loop of Henle and the collecting tubules are located in the _____.

g. Urine is formed in the _____ and in the _____ by filtration, reabsorption, and secretion.

OBJECTIVE 9

Label the major microscopic structures of a nephron. Write your answers on the blank lines provided below the following illustration.



a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____ h. _____

Objective 10

State seven of the functions of the kidneys. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

Objective 11

Complete statements that describe the characteristics and structure of the ureters. Write your answers on the blank lines provided in the statements below.

a. Each ureter is approximately _____ to _____ inches long and _____ inch in diameter.

b. The ureters begin as calyces in the _____ and end in the posterior floor of the _____.

c. The ureters consist of three tissue layers: an inner _____ membrane, a middle layer of _____ muscles, and an outer wall of _____ tissue.

d. Urine is carried through the ureters by peristaltic waves of the _____ tissue layer.

Objective 12

Complete statements that describe the characteristics and structure of the urinary bladder. Write your answers on the blank lines provided in the statements below and on the next page.

a. The urinary bladder is a hollow, muscular, membranous, collapsible sac located in the pelvis directly behind the _____.

b. The urinary bladder is held in position by a _____ or _____.

c. The urinary bladder has _____ to allow it to expand or collapse, depending on how much urine is present.

d. The urinary bladder has an average capacity of _____ to _____ cubic centimeters.

e. The three openings on the floor of the bladder form a triangle called the _____ with a ureter on each side and the urethra in the front.

f. Urine is emptied from the bladder through the urethra by contractions of its _____.

OBJECTIVE 13

Complete statements that describe the characteristics and structure of the female urethra. Write your answers on the blank lines provided in the statements below.

a. The female urethra is a short tube approximately _____ inches long and _____ inch in diameter that lies behind the _____ and is embedded in the wall of the vagina.

b. The urethra acts as a passageway for urine from the urinary _____ to the urinary _____.

c. The urethra contains an internal and an external _____.

d. The _____ open into the urethra at its termination to secrete lubricating fluid.

OBJECTIVE 14

Complete statements that describe the characteristics and structure of the male urethra. Write your answers on the blank lines provided in the statements below and on the next page.

a. The male urethra acts as a passageway for both _____ and _____.

b. The male urethra is a modified S-shaped tube approximately _____ to _____ inches long that consists of three divisions: the _____ division, the _____ division, and the _____ division.

c. After exiting the bladder from below, the _____ division passes through the center of the prostate gland.

d. The _____ division extends from the apex of the prostate and the bulb of the urethra between two sheets of white fibrous tissue that connect the pubic bones and is surrounded by the external sphincter muscle.

e. The _____ division extends from the pelvic walls through the penis to the urinary meatus.

OBJECTIVE 15

Complete statements that describe the normal physical characteristics of urine. Write your answers on the blank lines provided in the statements below.

a. Urine is a clear, straw-colored watery solution containing the waste products of _____.

b. Urine is straw-colored as a result of the excreted _____ pigments it contains.

c. Urine has an average pH of 6.0, with a normal range of 5.5 to 6.5 and is, thus, slightly _____.

d. Urine is slightly _____ than water, with a specific gravity of 1.015 to 1.025.

e. The amount of urine excreted is dependent on the amount of fluid intake and the amount of fluid lost through other mechanisms, such as respiration and perspiration; on the average, a person will excrete _____ to _____ cubic centimeters of urine per 24-hour period.

f. After standing for a short period of time, urine has the characteristic odor of _____.

g. The normal constituents of urine are _____, _____ substances, and _____ substances.

h. Normal urine is approximately _____ percent water.

i. The _____ substances in urine are largely protein waste products, including uric acid, urea, creatinine, ammonia, and hormones.

j. The _____ substances are primarily mineral salts, and include sodium chloride, sulfates, phosphates, potassium, magnesium, and calcium.

OBJECTIVE 16

Complete statements that describe the processes for producing and expelling urine. Write your answers on the blank lines provided in the statements below.

a. Blood carrying wastes flows into the _____.

b. The high blood pressure within the _____ forces blood plasma into the Bowman's capsules to filter it, producing a fluid called _____.

c. Nutrients, water, and minerals are reabsorbed from the filtrate and into the bloodstream of the _____.

d. The _____ secrete additional wastes and hydrogen into the filtrate.

e. _____ influence the amount of water that is reabsorbed to help maintain normal blood volume and pressure.

f. The waste products in the filtrate are carried from the body in _____.

g. The process of expelling urine is variously known as _____, _____, or _____.

h. For an average person, as the volume of urine in the bladder approaches _____ to _____ cubic centimeters, the pressure of bladder expansion creates an impulse in the central nervous system indicating a need to urinate.

i. Although urination is dependent on _____, humans learn partial voluntary control over urinating.

j. Expulsion of urine from the bladder is accomplished by contracting the walls of the _____ and _____ of the sphincter muscles at the junction of the urinary bladder and the urethra.

k. The _____ of the urethra controls the release of urine.

l. The inability to control urination, called _____, occurs in young children until control is learned and in the elderly in whom the sphincter has weakened.

Objective 17 List the common abnormal constituents of urine. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

e. _____

Objective 18 Complete statements that describe the characteristics of calculi in the urinary tract. Write your answers on the blank lines provided in the statements below.

a. Calculi may form in the _____ or any other part of the _____.

b. Because they contain calcium, calculi are usually _____.

c. Calculi usually form as a result of excessive amounts of _____, _____, or other _____; a decrease in the amount of _____; or excessively _____ or _____ urine.

Objective 19 Define common disorders and abnormalities of the urinary system. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Glycosuria _____

_____

b. Proteinuria _____

_____

c. Hematuria _____

_____

d. Bacteriuria _____

_____

e. Pyuria _____

_____

f. Ketonuria _____

_____

g. Gout _____

_____

h. Cystitis _____

_____

i. Nephritis _____

_____

j. Urethritis _____

_____

k. Dysuria _____

_____

l. Polyuria _____

_____

m. Oliguria _____

_____

n. Urethral stricture _____

_____

o. Urinary incontinence _____

_____

p. Urinary retention _____

_____

q. Urinary suppression _____

_____

r. Renal ptosis _____

_____

s. Renal failure _____

_____

Answers to Written Test

Objective 1

All of the organs involved in the secretion and elimination of urine

Objective 2

Answers may appear in any order.

a. Filters the blood by removing various toxins, metabolic waste products, and some water

b. Manufactures and excretes urine

c. Assists in regulation of water, electrolyte, and acid-base balance of the body

d. Influences blood pressure

Objective 3

a. One of a pair of bean-shaped urinary organs in the dorsal part of the abdomen, one on each side of the vertebral column

b. One of a pair of thick-walled tubes that carries urine from the kidney into the urinary bladder

c. The muscular membranous sac in the pelvis that stores urine for discharge through the urethra

d. The small, tubular structure that drains urine from the bladder

Objective 4

a. Right kidney
b. Right ureter
c. Urinary bladder
d. Urethra
e. Left ureter
f. Left kidney

Objective 5

a. abdomen
b. left; right
c. right; left
d. adipose capsule
e. adipose capsule; renal fascia
f. hilum
g. hilum
h. microscopic structures
i. renal vein

Objective 6

a. The soft, granular, outer layer of a kidney

b. The middle portion of the kidney that lies beneath the renal cortex and contains the cone-shaped structures called *renal pyramids*

c. The funnel-shaped inner portion of the kidney that contains the cuplike cavities called *calyces*, where urine is collected before it is sent to the ureter

Objective 7

a. Renal cortex
b. Renal medulla (renal pyramid)
c. Renal pelvis
d. Renal calyx

Objective 8

a. renal cortex; renal medulla
b. renal corpuscle; renal tubule
c. renal corpuscle
d. renal tubule
e. renal cortex
f. renal medulla
g. renal corpuscle; renal tubule

Objective 9

a. Bowman's capsule
b. Glomerulus
c. Loop of Henle
d. Collecting tubule
e. Renal medulla
f. Renal cortex
g. Distal convoluted tubule
h. Proximal convoluted tubule

Objective 10

Answers should include any seven of the following. Answers may appear in any order.

a. Filter the liquid portion of blood in the distal part of the nephrons

b. Manufacture urine

c. Excrete urine from the proximal portion of the nephrons

d. Influence blood pressure

e. Regulate the fluid content of the blood by separating out the constituents of urine from the blood

f. Regulate the concentration of the various salts circulating in the blood

g. Extract foreign substances from the body, such as toxins, whether formed in the body or taken into the body from the outside

h. Regulate osmotic pressure of extracellular fluid

i. Regulate electrolyte and acid-base balance

Objective 11

a. 10; 12; ¼
b. renal pelvis; urinary bladder
c. mucous; smooth; fibrous
d. muscular

Objective 12

a. symphysis pubis
b. peritoneal fold; fascia
c. rugae
d. 300; 500
e. trigone area
f. muscular walls

Objective 13

a. 1½; ¼; symphysis pubis
b. bladder; meatus
c. sphincter
d. Skene's glands

Objective 14

a. urine; seminal fluid
b. 8; 10; prostatic; membranous; cavernous
c. prostatic
d. membranous
e. cavernous (anterior)

Objective 15

a. metabolism
b. bile
c. acidic
d. heavier
e. 1000; 1800
f. ammonia
g. water; organic; inorganic
h. 95
i. organic
j. inorganic

Objective 16

a. kidneys
b. glomeruli; renal filtrate
c. peritubular capillaries
d. capillaries
e. Hormones
f. excreted urine
g. urination; voiding; micturition
h. 200; 250
i. involuntary reflexes
j. bladder; relaxation
k. external sphincter
l. incontinence

Objective 17

Answers may appear in any order.

a. Glucose
b. Albumin
c. Blood
d. Pus cells
e. Acetone

Objective 18

a. kidneys; urinary tract
b. radiopaque
c. calcium; sodium; mineral salts; water; acidic; alkaline

Objective 19

a. The abnormal presence of a sugar—especially glucose—in the urine
b. The presence in the urine of abnormally large quantities of protein, usually albumin
c. The abnormal presence of blood in the urine
d. The presence of bacteria in the urine
e. The presence of white blood cells in the urine, which is usually a sign of infection in the urinary tract
f. The presence in the urine of excessive amounts of ketone bodies
g. A metabolic disease that increases the production of or interferes with the excretion of uric acid, resulting in deposits of uric acid in the blood
h. An inflammation of the urinary bladder and ureters that is characterized by pain, by urgency and frequency of urination, and by hematuria
i. An inflammation of the kidneys
j. An inflammation of the urethra
k. Painful urination that is usually the result of a bacterial infection or obstruction in the urinary tract
l. The excretion of an abnormally large quantity of urine
m. The diminished capacity to form and pass urine
n. A narrowing of the urethra
o. The inability to control urination; involuntary urination
p. The inability to completely empty the urinary bladder when it is full
q. The inability to void because the kidneys are not secreting any urine and the bladder is empty
r. The shifting of a kidney, usually to a lower position in the pelvis
s. The inability of the kidneys to function properly—excrete wastes, concentrate urine, and conserve electrolytes

Answers to Assignment Sheet

Assignment Sheet 1

Investigation points for the role of the donor

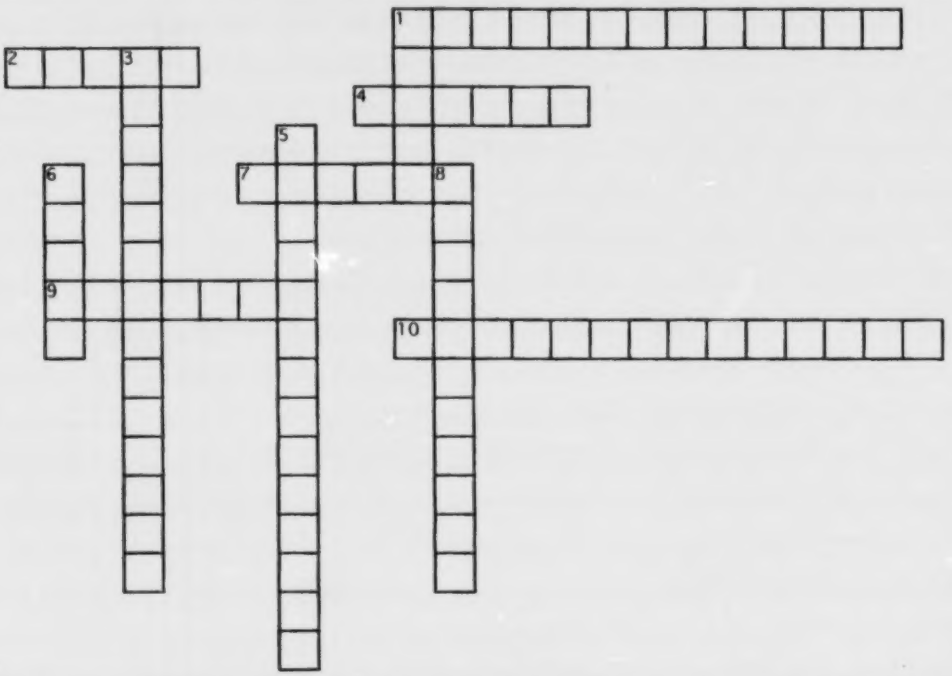
Answers must be evaluated to the satisfaction of the instructor.

Investigation points for the role of the recipient

Answers must be evaluated to the satisfaction of the instructor.

Crossword Puzzle 1—Terms from Objectives 1 Through 5

Name _____ Date _____



ACROSS

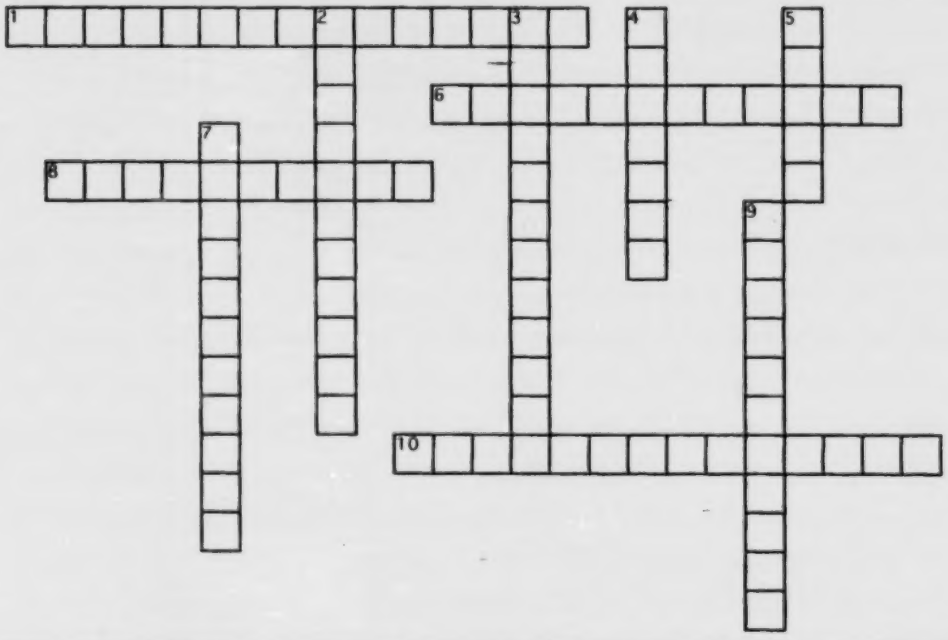
1. All of the organs involved in the secretion and elimination of urine (2 words)
2. Relating to the kidneys
4. One of a pair of bean-shaped urinary organs in the dorsal part of the abdomen, one on each side of the vertebral column
7. One of a pair of thick-walled tubes that carries urine from the kidney into the urinary bladder
9. The small, tubular structure that drains urine from the bladder
10. The result of a kidney becoming dislodged from its suspension system (2 words)

DOWN

1. The waste material that is secreted by the kidneys
3. A pocket of fatty tissue which protects the kidney from external blows and helps hold it in position (2 words)
5. The muscular membranous sac in the pelvis that stores urine for discharge through the urethra (2 words)
6. The depression on the inner (medial) border of each kidney
8. A web of fibrous tissue in which the kidney and adipose capsule are suspended, which anchors the kidney to surrounding structures and also helps hold it in position (2 words)

Crossword Puzzle 2—Terms from Objectives 6 Through 10

Name _____ Date _____



ACROSS

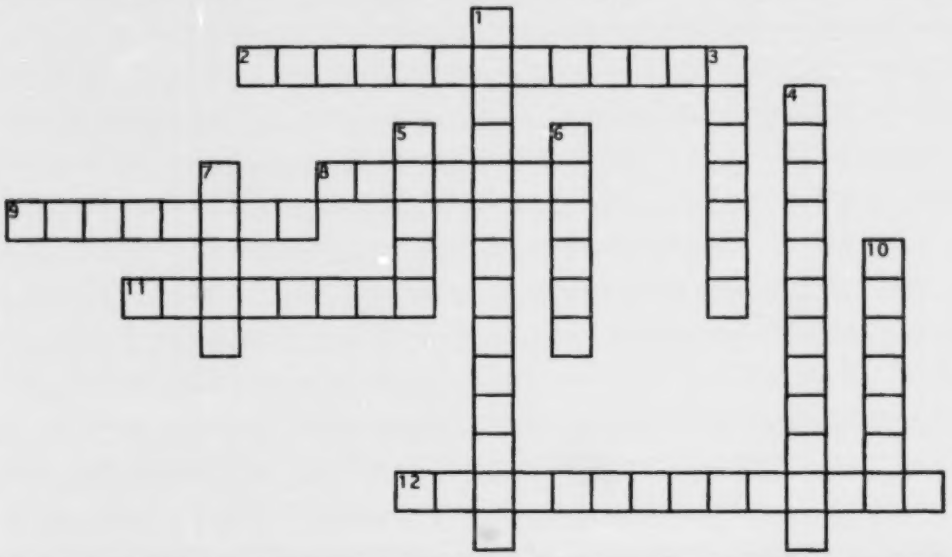
1. The force that creates a flow of fluid from areas of higher concentration to lower concentration (2 words)
6. The narrow point of each renal pyramid (2 words)
8. A structure composed of capillaries
10. One major structure of a nephron consisting of a glomerulus of renal capillaries enclosed within a funnel-shaped renal tubule called *Bowman's capsule* (2 words)

DOWN

2. The soft, granular, outer layer of a kidney (2 words)
3. The middle portion of the kidney that lies beneath the renal cortex and contains the cone-shaped structures called *renal pyramids*
4. One of the approximately 1 million funnel-shaped microscopic structures located along the interface of the renal cortex and the renal medulla
5. The structure that collects urine from the renal papilla of each renal pyramid
7. The funnel-shaped inner portion of the kidney that contains the cuplike cavities called *calyces*, where urine is collected before it is sent to the ureter (2 words)
9. One major structure of a nephron consisting of four sections: the proximal convoluted tubule, the loop of Henle, the distal convoluted tubule, and the collecting tubule (2 words)

Crossword Puzzle 3—Terms from Objectives 12 and 13

Name _____ Date _____



ACROSS

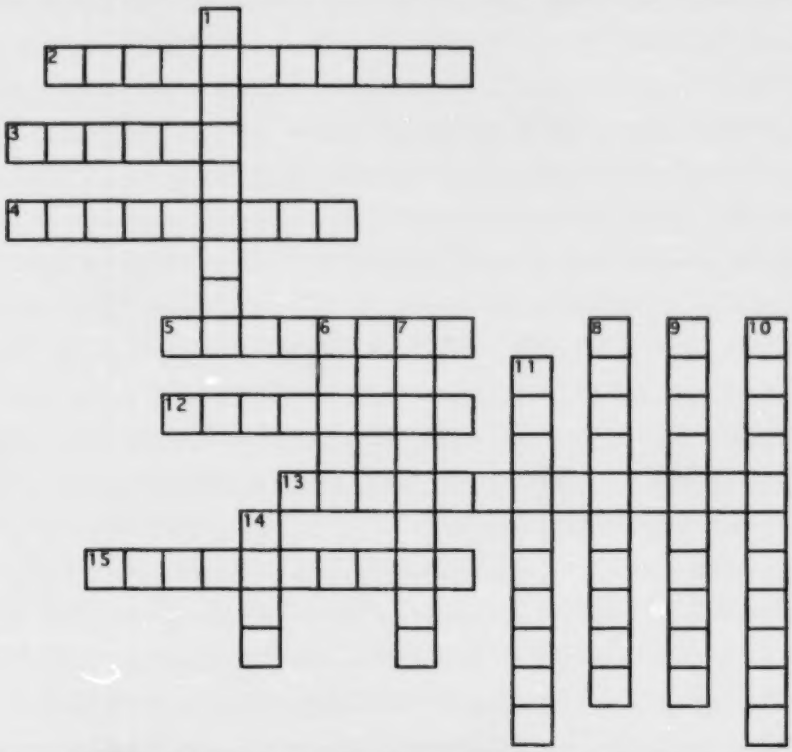
2. The external opening of the urethra (2 words)
8. In a female, the short tube acting as a passageway for urine from the urinary bladder to the urinary meatus; in a male, the tube acting as a passageway for urine and seminal fluid
9. The firm, partly muscular, partly glandular body located at the base of the male urethra that produces a secretion that liquifies coagulated semen
11. The vaginal erectile structure
12. A hollow, muscular, membranous, collapsible sac located in the pelvis directly behind the symphysis pubis (2 words)

DOWN

1. The slightly movable interpubic joint of the pelvis, consisting of two pubic bones separated by a disc of fibrocartilage and connected by two ligaments (2 words)
3. The external pouch that contains the testes
4. The largest glands opening into the urethra of women (2 words)
5. The external reproductive organ of a man that also functions as the channel by which urine leaves the body
6. The canal in a female that leads from the uterus to the external opening of the genital canal
7. The folds at the margin of the vulva
10. The triangular area created by the three openings on the floor of the bladder (2 words)

Crossword Puzzle 4—Terms from Objectives 15 Through 19

Name _____ Date _____



ACROSS

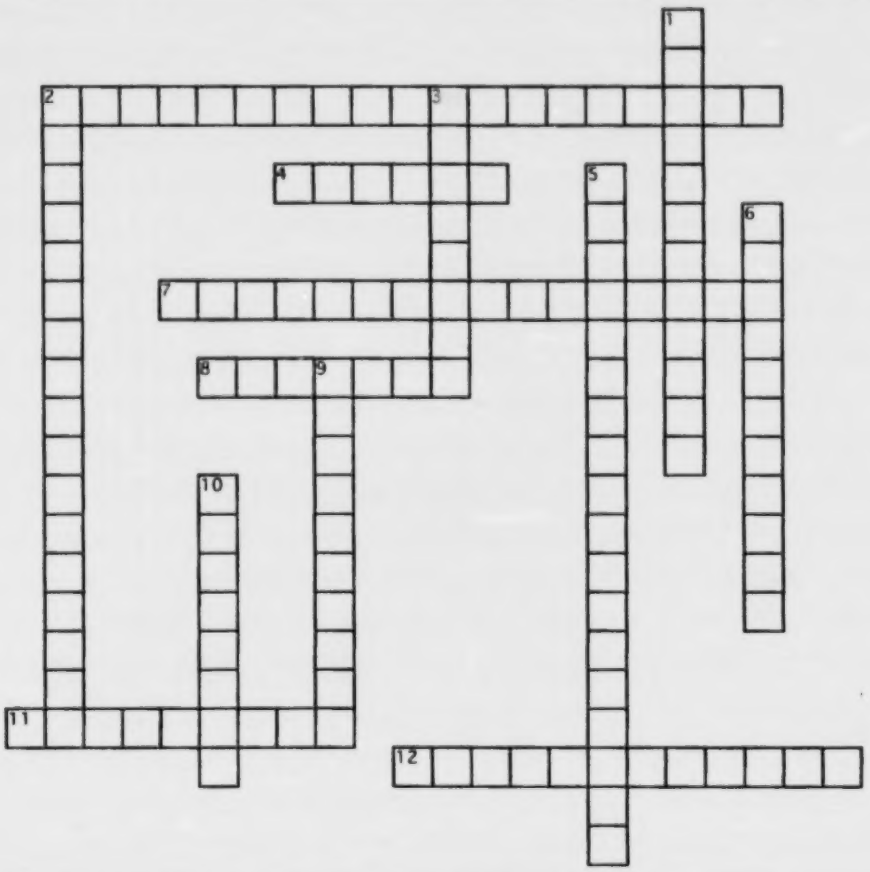
2. The presence of bacteria in the urine
3. The presence of white blood cells in the urine, which is usually a sign of infection in the urinary tract
4. The presence in the urine of excessive amounts of ketone bodies
5. A particle found in the kidney or urinary tract that forms as a result of mineral deposits, generally of salts formed from ingested materials; also called *kidney stones*
12. An inflammation of the urinary bladder and ureters that is characterized by pain, by urgency and frequency of urination, and by hematuria
13. A fluid produced when high blood pressure within the glomeruli forces blood plasma into the Bowman's capsules to filter it (2 words)
15. The abnormal presence of a sugar—especially glucose—in the urine

DOWN

1. The abnormal presence of blood in the urine
6. A clear, straw-colored watery solution containing the waste products of metabolism
7. The process of expelling urine; also called *voiding*, or *micturition*
8. The by-product of cellular respiration formed from creatine phosphate
9. A test performed to determine the chemical makeup of urine
10. The presence in the urine of abnormally large quantities of protein, usually albumin
11. Referring to a substance that is capable of reducing the amount of x-ray energy that passes through it, thus making it visible in a radiograph
14. A metabolic disease that increases the production of or interferes with the excretion of uric acid, resulting in deposits of uric acid in the blood

Crossword Puzzle 5—Terms from Objective 19 (cont.)

Name _____ Date _____



ACROSS

2. The inability to control urination; involuntary urination (2 words)
4. A falling, dropping, or prolapse of an organ
7. The inability to completely empty the urinary bladder when it is full (2 words)
8. Painful urination that is usually the result of a bacterial infection or obstruction in the urinary tract
11. An inflammation of the kidneys
12. The process that uses a machine to remove blood from an artery, purify it, add vital substances, and return it to a vein in order to prevent death during renal failure

DOWN

1. The inability of the kidneys to function properly—excrete wastes, concentrate urine, and conserve electrolytes (2 words)
2. A narrowing of the urethra (2 words)
3. The diminished capacity to form and pass urine
5. The inability to void because the kidneys are not secreting any urine and the bladder is empty (2 words)
6. The shifting of a kidney, usually to a lower position in the pelvis (2 words)
9. An inflammation of the urethra
10. The excretion of an abnormally large quantity of urine

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. URINARY SYSTEM
2. RENAL
4. KIDNEY
7. URETER
9. URETHRA
10. FLOATING KIDNEY

DOWN
1. URINE
3. ADIPOSE CAPSULE
5. URINARY BLADDER
6. HILUM
8. RENAL FASCIA

Crossword Puzzle 2

ACROSS
1. OSMOTIC PRESSURE
6. RENAL PAPILLA
8. GLOMERULUS
10. RENAL CORPUSCLE

DOWN
2. RENAL CORTEX
3. RENAL MEDULLA
4. NEPHRON
5. CALYX
7. RENAL PELVIS
9. RENAL TUBULE

Crossword Puzzle 3

ACROSS
2. URINARY MEATUS
8. URETHRA
9. PROSTATE
11. CLITORIS
12. URINARY BLADDER

DOWN
1. SYMPHYSIS PUBIS
3. SCROTUM
4. SKENES GLANDS
5. PENIS
6. VAGINA
7. LABIA
10. TRIGONE

Crossword Puzzle 4

ACROSS
2. BACTERIURIA
3. PYURIA
4. KETONURIA
5. CALCULUS
12. CYSTITIS
13. RENAL FILTRATE
15. GLYCOSURIA

DOWN
1. HEMATURIA
6. URINE
7. URINATION
8. CREATININE
9. URINALYSIS
10. PROTEINURIA
11. RADIOPAQUE
14. GOUT

Crossword Puzzle 5

ACROSS

2. URINARY INCONTINENCE
4. PTOSIS
7. URINARY RETENTION
8. DYSURIA
11. NEPHRITIS
12. HEMODIALYSIS

DOWN

1. RENAL FAILURE
2. URETHRAL STRICTURE
3. OLIGURIA
5. URINARY SUPPRESSION
6. RENAL PTOSIS
9. URETHRITIS
10. POLYURIA

Module Review

Name _____

Date _____ Score _____

Directions Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 14

1. After exiting the bladder from below, the prostatic division of the male urethra _____.
   a. merges with the prostate gland
   b. passes through the center of the prostate gland
   c. encircles the prostate gland
   d. terminates in the center of the prostate gland

Objective 10

2. The kidneys filter the liquid portion of blood in the _____ part of the nephrons.
   a. distal
   b. proximal
   c. medial
   d. lateral

Objective 13

3. The female urethra acts as a passageway for urine from the urinary bladder to the _____.
   a. rectum
   b. ureter
   c. external sphincter
   d. urinary meatus

Objective 19

4. _____ is an inflammation of the kidneys.
   a. Nephritis
   b. Cystitis
   c. Urethritis
   d. Kidnitis

Objective 10

5. The kidneys excrete urine from the _____ portion of the nephrons.

   a. distal

   b. proximal

   c. medial

   d. lateral

Objective 5

6. Which of the following is a correct statement about the kidneys?

   a. Each kidney measures about 5 by 8 inches.

   b. The kidneys lie against the posterior wall of the abdomen.

   c. The right kidney is usually slightly larger than the left kidney.

   d. The kidneys lie anterior to the peritoneum.

Objective 11

7. Which of the following is NOT a correct statement about the ureters?

   a. The ureters are two tubes approximately 10 to 12 inches long and ¼ inch in diameter.

   b. The ureters consist of an inner fibrous layer, a middle muscle layer, and an outer mucous membrane.

   c. The ureters begin as calyces in the renal pelvis and end in the posterior floor of the urinary bladder.

   d. The ureters carry urine through peristaltic waves of the muscular layer.

Objective 14

8. The male urethra is a modified S-shaped tube approximately _____ long.

   a. 2 to 4 inches

   b. 6 to 7 inches

   c. 8 to 10 inches

   d. 12 to 14 inches

Objective 8

9. Urine is formed in the renal _____ and in the renal _____ by filtration, reabsorption, and secretion.

   a. cortex; pelvis

   b. corpuscle; tubule

   c. artery; vein

   d. calyx; pelvis

Objective 15

10. On the average, a person will excrete _____ cubic centimeters of urine per 24-hour period.

    a. 200 to 300

    b. 600 to 900

    c. 1000 to 1800

    d. 2000 to 3000

Objective 6

11. The renal _____ is the funnel-shaped inner portion of a kidney that contains cuplike cavities called *calyces*.

    a. cortex

    b. hilum

    c. medulla

    d. pelvis

Objective 13

12. The female urethra contains an _____ sphincter.

    a. internal

    b. external

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 10

13. Which of the following is NOT a function of the kidneys?

    a. absorb urine

    b. influence blood pressure

    c. regulate the concentration of the various salts circulating in the blood

    d. regulate electrolyte and acid-base balance

Objective 19

14. The inability of the kidneys to function properly is _____.

    a. hemodialysis

    b. acetonuria

    c. incontinence

    d. renal failure

Objective 12

15. Which of the following is NOT a true statement about the urinary bladder?

    a. The urinary bladder is a hollow, muscular, membranous, collapsible sac.

    b. The urinary bladder is located in the pelvis directly in front of the symphysis pubis and behind the sigmoid colon.

    c. The urinary bladder has rugae to allow it to expand or collapse, depending on how much urine is present.

    d. The urinary bladder serves as a reservoir for urine and has an average capacity of 300 to 500 cubic centimeters.

Objective 2

16. Which of the following statements is NOT a function of the urinary system?

    a. The urinary system filters the chyme by removing various toxins, metabolic waste products, and some water.

    b. The urinary system manufactures and excretes urine.

    c. The urinary system assists in regulation of water, electrolyte, and acid-base balance of the body.

    d. The urinary system influences blood pressure.

Objective 14

17. The _____ division of the male urethra extends from the apex of the prostate and the bulb of the urethra between two sheets of white fibrous tissue that connect the pubic bones and is surrounded by the external sphincter muscle.

    a. membranous

    b. prostatic

    c. cavernous

    d. anterior

Objective 12

18. Urine is emptied from the bladder through the urethra by _____.

    a. peristaltic waves of the ureters

    b. contractions of the muscular walls

    c. contractions of the triad

    d. contractions of the trigone

Objective 19

19. A metabolic disease that results in deposits of uric acid in the blood is called _____.

a. *gout*

b. *renal calculi*

c. *renal ptosis*

d. *cholelithiasis*

Objective 13

20. The female urethra lies behind the symphysis pubis and is embedded in the wall of the _____.

a. urinary bladder

b. vagina

c. rectum

d. coccyx

Objective 8

21. There are approximately one _____ nephrons in each kidney.

a. hundred

b. thousand

c. hundred thousand

d. million

Objective 3

22. The _____ is the small, tubular structure that drains urine from the bladder.

a. kidney

b. right ureter

c. left ureter

d. urethra

Objective 14

23. The male urethra acts as a passageway for urine and _____.

a. seminal fluid

b. gastric fluid

c. perspiration

d. sebaceous fluid

Objective 5

24. The _____ anchors each kidney to surrounding structures and helps hold it in position.

a. adipose capsule

b. hilum

c. renal fascia

d. renal artery

Objective 15

25. Which of the following statements is true with regard to urine?

a. Urine is a clear, watery solution containing the waste products of metabolism.

b. Urine is straw-colored as a result of excreted proteins.

c. Urine has an average pH of 6.0, with a normal range of 5.5 to 6.5 and is, thus, slightly base.

d. Urine is slightly lighter than water, with a specific gravity of 1.015 to 1.025.

Objective 8

26. Which of the following is NOT one of the four sections of a renal tubule?

a. the proximal convoluted tubule

b. the loop of Henle

c. the distal convoluted tubule

d. the evoluted tubule

Objective 1

27. The urinary system consists of all the organs involved in the _____ and _____ of urine.

a. secretion; filtering

b. secretion; elimination

c. filtering; elimination

d. filtering; calculi formation

Objective 15

28. The amount of urine excreted is dependent on the amount of _____.

a. fluid intake

b. fluid lost through mechanisms such as respiration

c. fluid lost through mechanisms such as perspiration

d. all of the above

Objective 13

29. The _____ open into the female urethra at its termination to secrete lubricating fluid.

a. Skene's glands

b. vas deferens

c. sebaceous glands

d. ampullae of Vater

Objective 8

30. The renal corpuscle is the portion of a nephron that includes a network of capillaries called a _____ enclosed within a sheath of cells called a _____.

a. *distal tubule; proximal tubule*

b. *proximal tubule; distal tubule*

c. *Bowman's capsule; glomerulus*

d. *glomerulus; Bowman's capsule*

Objective 15

31. After standing for a short period of time, urine has a characteristic odor of _____.

a. vinegar

b. ammonia

c. rotten eggs

d. chlorine

Objective 19

32. _____ is a narrowing of the urethra.

a. Urethral stricture

b. Urethritis

c. Urethral collapse

d. Bowman's capsule

Objective 16

33. The process of expelling urine is known as _____.

a. *urination*

b. *voiding*

c. *micturition*

d. all of the above

Objective 18

34. Calculi contain _____.

a. proteins and are usually radiopaque

b. proteins and are not radiopaque

c. calcium and are usually radiopaque

d. calcium and are not radiopaque

Objective 16

35. Expulsion of urine from the bladder is accomplished by contracting the walls of the _____ and relaxation of the _____ at the junction of the urinary bladder and the urethra.

a. kidneys; sphincter muscles

b. kidneys; micturition valve

c. bladder; sphincter muscles

d. bladder; micturition valve

Objective 13

36. The female urethra is a short tube approximately _____ long and ¼ inch in diameter.

a. 1½ inches

b. 3 inches

c. 5 inches

d. 6 inches

Objective 19

37. Hematuria is a condition in which _____ is found in the urine.

a. blood

b. glucose

c. albumin

d. pus cells

Objective 16

38. Which of the following statements is most correct about urination?

a. Urination is entirely a voluntary reflex.

b. Urination is entirely an involuntary reflex.

c. Although urination is dependent on involuntary reflexes, humans learn partial voluntary control over urinating.

d. none of the above

Objective 17

39. Blood, pus cells, glucose, and albumin are _____.

a. normal constituents of urine

b. abnormal constituents of urine

c. never found in urine

d. converted into urine as part of the normal urinary process

Objective 12

40. The urinary bladder is held in position by _____.

a. the ureters

b. the urethra

c. the symphysis pubis

d. a peritoneal fold or fascia

Objective 18

41. Which of the following statements is NOT correct about the formation of calculi?

a. Calculi may form in the kidneys but not in any other part of the urinary tract.

b. Calculi may form as a result of excessive amounts of sodium.

c. Calculi may form as a result of excessive amounts of calcium.

d. Calculi may form as a result of a decrease in the amount of water.

Objective 11

42. The ureters carry urine through _____.

a. peristaltic waves of the fibrous tissue

b. peristaltic waves of the muscular layer

c. peristaltic waves of the mucous layer

d. alternate opening and closing of the two sphincter valves

Objective 19

43. Diminished capacity to form and pass urine is known as _____.

a. *pyuria*

b. *dysuria*

c. *oliguria*

d. *polyuria*

Objective 12

44. The three openings on the floor of the bladder form a triangle called the _____ *area* with a ureter on each side and the urethra in the _____.

    a. *triad*; front

    b. *triad*; back

    c. *trigone*; front

    d. *trigone*; back

Objective 3

45. A _____ is one of the bean-shaped urinary organs in the dorsal part of the abdomen, one on each side of the vertebral column.

    a. kidney

    b. ureter

    c. urinary bladder

    d. urethra

Objective 19

46. The inability to void when the bladder is full is called _____.

    a. *urinary incontinence*

    b. *urinary retention*

    c. *urinary suppression*

    d. *renal ptosis*

Objectives 15 & 17

47. Which of the following is NOT a normal constituent of urine?

    a. inorganic substances

    b. organic substances

    c. water

    d. acetone

Objective 19

48. The inability to void when the kidneys are not secreting any urine and the bladder is empty is called _____.

    a. *urinary incontinence*

    b. *urinary retention*

    c. *urinary suppression*

    d. *renal ptosis*

Objective 7

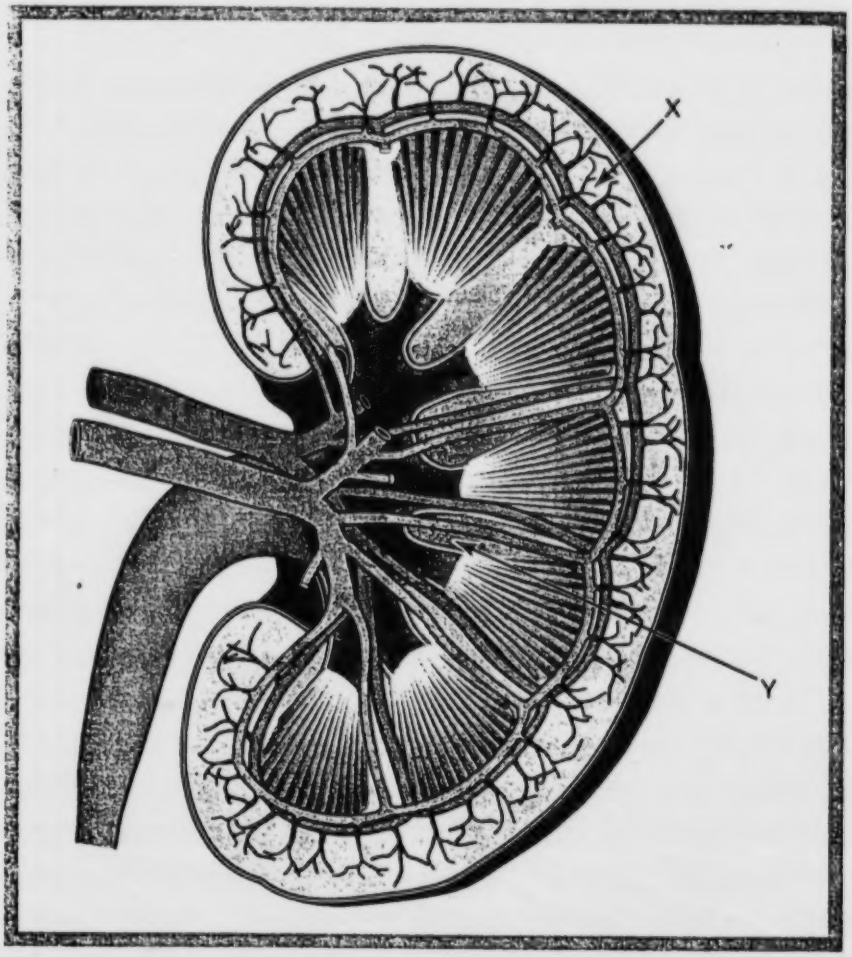
49. The structure indicated by the letter "X" in the illustration below is the renal _____.

a. cortex

b. hilum

c. medulla

d. pelvis



Objective 7

50. The structure indicated by the letter "Y" in the illustration above is the renal _____.

a. cortex

b. hilum

c. calyx

d. medulla

Objective 4

51. The structure indicated by the letter "W" in the illustration on the next page is the _____.

    a. right kidney
    b. left kidney
    c. ureter
    d. urinary bladder

Objective 4

52. The structure indicated by the letter "X" in the illustration on the next page is the _____.

    a. right kidney
    b. left kidney
    c. ureter
    d. urinary bladder

Objective 4

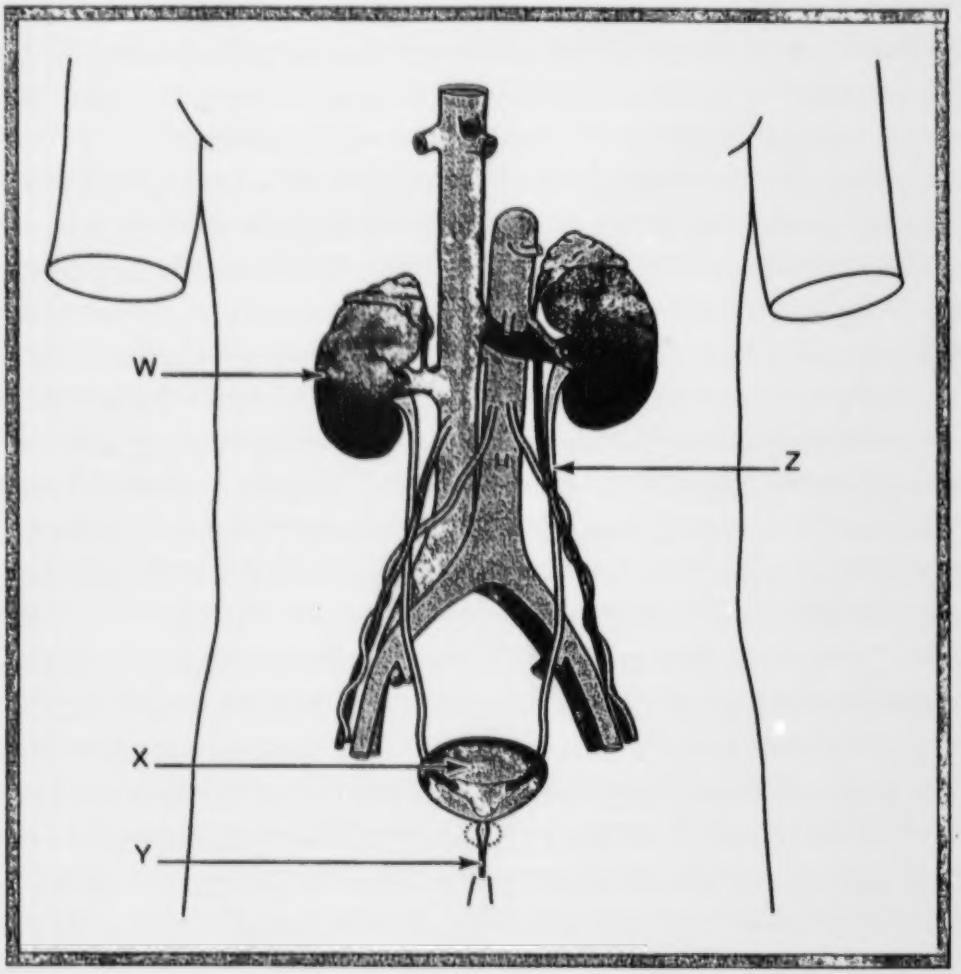
53. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

    a. right ureter
    b. right kidney
    c. urinary bladder
    d. urethra

Objective 4

54. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

    a. right kidney
    b. urethra
    c. left kidney
    d. left ureter



Objective 16

55. For an average person, as the volume of urine in the bladder approaches _____ cubic centimeters, the pressure of bladder expansion creates an impulse in the central nervous system indicating a need to urinate.

a. 100 to 150

b. 200 to 250

c. 500 to 600

d. 1000 to 1500

Objective 9

56. The structure indicated by the letter "V" in the illustration on the next page is _____.

a. Bowman's capsule

b. the loop of Henle

c. the renal cortex

d. a collecting tubule

Objective 9

57. The structure indicated by the letter "W" in the illustration on the next page is _____.

a. Bowman's capsule

b. the loop of Henle

c. the renal cortex

d. a glomerulus

Objective 9

58. The structure indicated by the letter "X" in the illustration on the next page is _____.

a. a proximal convoluted tubule

b. a distal convoluted tubule

c. a collecting tubule

d. the loop of Henle

Objective 9

59. The structure indicated by the letter "Y" in the illustration on the next page is the renal _____.

a. medulla

b. cortex

c. pelvis

d. calyx

Objective 9

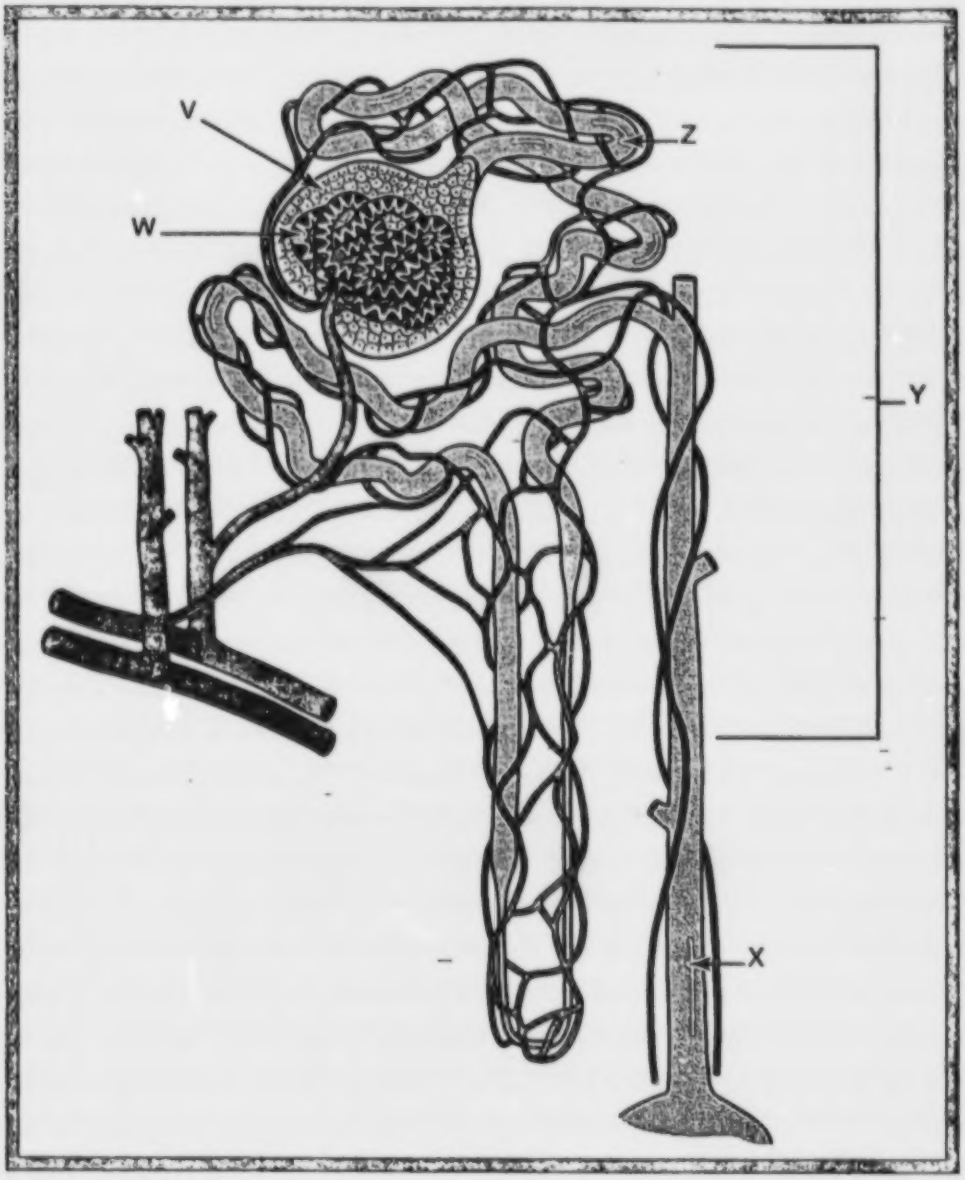
60. The structure indicated by the letter "Z" in the illustration on the next page is _____.

a. a proximal convoluted tubule

b. a distal convoluted tubule

c. a collecting tubule

d. the loop of Henle


V
W
Z
Y
X

Answers to Module Review

1. b	13. a	25. a	37. a	49. a
2. a	14. d	26. d	38. c	50. c
3. d	15. b	27. b	39. b	51. a
4. a	16. a	28. d	40. d	52. d
5. b	17. a	29. a	41. a	53. d
6. b	18. b	30. d	42. b	54. d
7. b	19. a	31. b	43. c	55. b
8. c	20. b	32. a	44. c	56. a
9. b	21. d	33. d	45. a	57. d
10. c	22. d	34. c	46. b	58. c
11. d	23. a	35. c	47. d	59. b
12. c	24. c	36. a	48. c	60. a

MODULE SET II:
Major Body Systems

Module 14: Reproductive System—Male

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Male Reproductive System	7
2—Major Glands and Structures of the Male Reproductive System	9
Written Test	11
Answers to Written Test	19
Answers to Assignment Sheet	23
Crossword Puzzles	
1—Terms from Objectives 1 and 2	25
2—Terms from Objectives 3 and 4	27
3—Terms from Objectives 6 Through 9	29
4—Terms from Objectives 10 Through 14	31
5—Terms from Objective 15	33
Answers to Crossword Puzzles	35
Module Review	37
Answers to Module Review	49

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activity Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 5 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module covers the male reproductive system while the next module covers the female reproductive system, menstruation, and pregnancy. This module will introduce concepts that are applicable to both systems, such as fertility and sterility as well as sexually transmitted diseases. Certain concepts regarding conception are also presented in both modules. Consequently, you may choose to review the objectives in both modules and determine how you want to sequence the presentation.

- Use crossword puzzles 1 through 5 to help reinforce the terms in the associated objectives.
- Introduce the module by giving a quick overview of the male reproductive system as you discuss the term *male reproductive system*, as presented in Objective 1.
- While three functions of the male reproductive system are presented in Objective 2, it is important that the students understand that these functions are relevant to both the male and female reproductive systems and that all of the functions are interrelated. The overall purpose of the reproductive system is to perpetuate the species. Sexual gratification is basically the personal motivation that leads humans to engage in intercourse that may lead to conception. The secreted hormones help to create sexual drive and also prepare the body biologically to allow conception.
- Use the following strategies in your discussion of Objective 3 through Objective 14.
  - Use illustrations and other media to discuss the development of sexual characteristics. One approach is to compare the development of male and female anatomies from fetuses through puberty and maturity.
  - Trace the development of seminal fluid through gland secretions and through the act of ejaculation. Discuss the role of the various secretions. Discuss vasectomies and disorders that may interrupt the delivery of sperm. Based on the objectives of your course, you may choose to go into more detail about spermatogenesis. Discuss the importance of sperm fertility and motility in successful conception. Discuss contraceptives in general, particularly as related to the male reproductive system, such as spermicides and condoms.
  - Using illustrations and other aids, discuss the structure and functioning of the penis. Reinforce student knowledge of the male urinary system.
  - Provide slides or other aids that allow students to view seminal fluid. Review the figures presented regarding number of sperm and amount of seminal fluid per ejaculation. These are general estimates and authorities vary greatly on the figures cited. Adjust as appropriate for your course. Convert between cc and ml per the practices for your course.

- Objective 15 discusses the common disorders and abnormalities of the male reproductive system. Talk with the class about the fact that, in recent years, sexual dysfunction—including impotence—has gained a great deal of publicity. However, there is still much to be explored about the physiology and emotional aspects of sterility, impotence, sexual-organ abnormalities, and sexually transmitted diseases.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.
- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites offer general information about the male reproductive system. Other modules list sites specific to the systems and disorders presented in that module.

- http://www.prostate.com/

  While this is a commercial site, it offers some good information about the prostate gland and its disorders.

- http://www.kumc.edu/instruction/medicine/anatomy/histoweb/male/male.htm

  This site provides numerous slides of male reproductive anatomy.

- http://www.ontumor.com/testicular/index.htm

  This site provides information about the causes, assessment, and treatment of testicular cancer.

- http://maleimpotence.net/

  This site offers very good information about male impotence, its causes, treatment, and complexities.

- http://www.healthanswers.com/Library/MedEnc/Index/dis-A.asp

  This site provides information about a variety of sexually transmitted diseases.

- http://www.msms.doe.k12.ms.us/biology/anatomy/reproductive/male.html

  This site provides good basic general information about the male reproductive system.

- http://www.cals.ncsu.edu/course/ent425/tutorial/males.html

  Using a tutorial approach, this site offers good general information about the male reproductive system.

- http://www.cdc.gov/cancer/prostate/prostate.htm

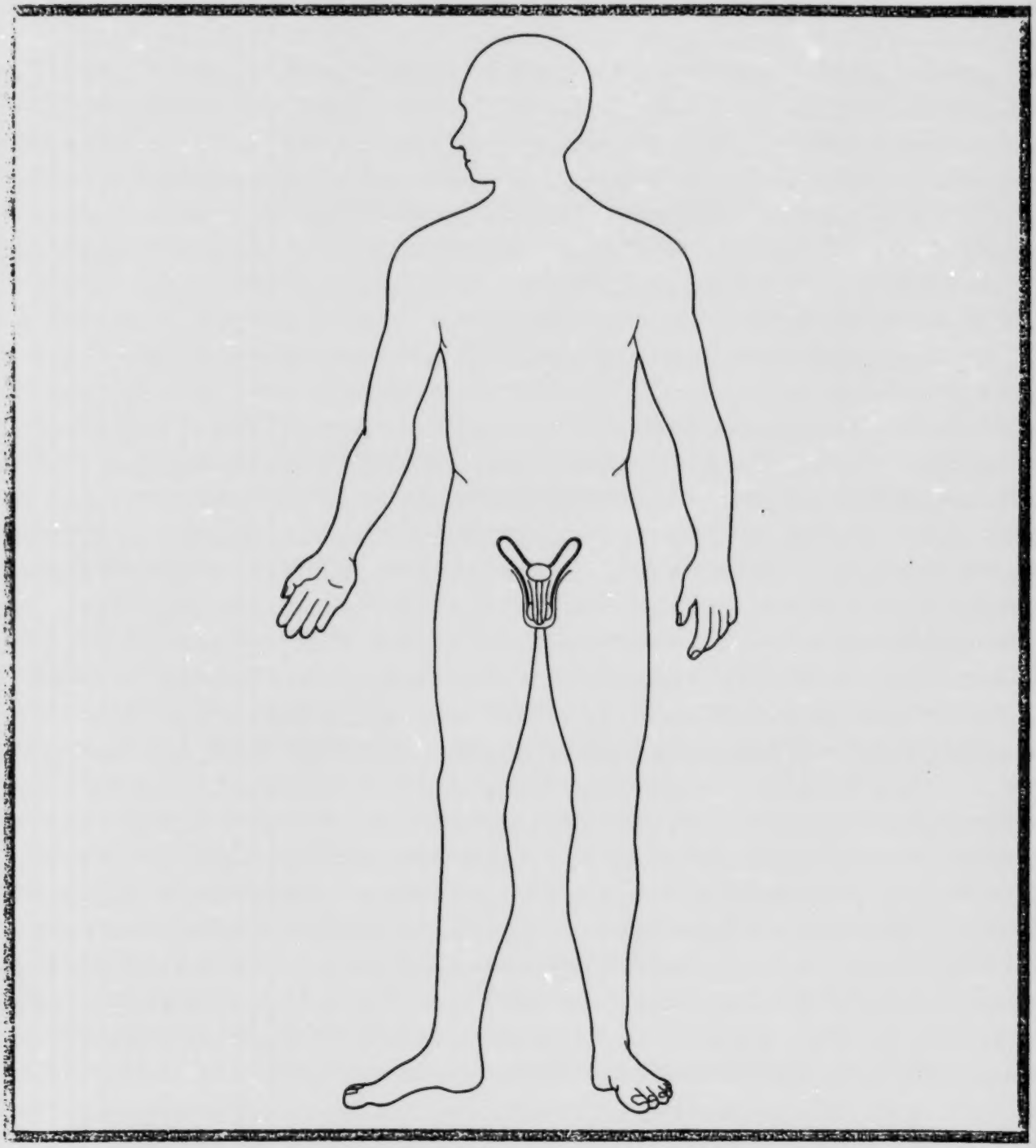
  This is the National Institute of Health's site for prostate cancer.

- http://www.4npcc.org

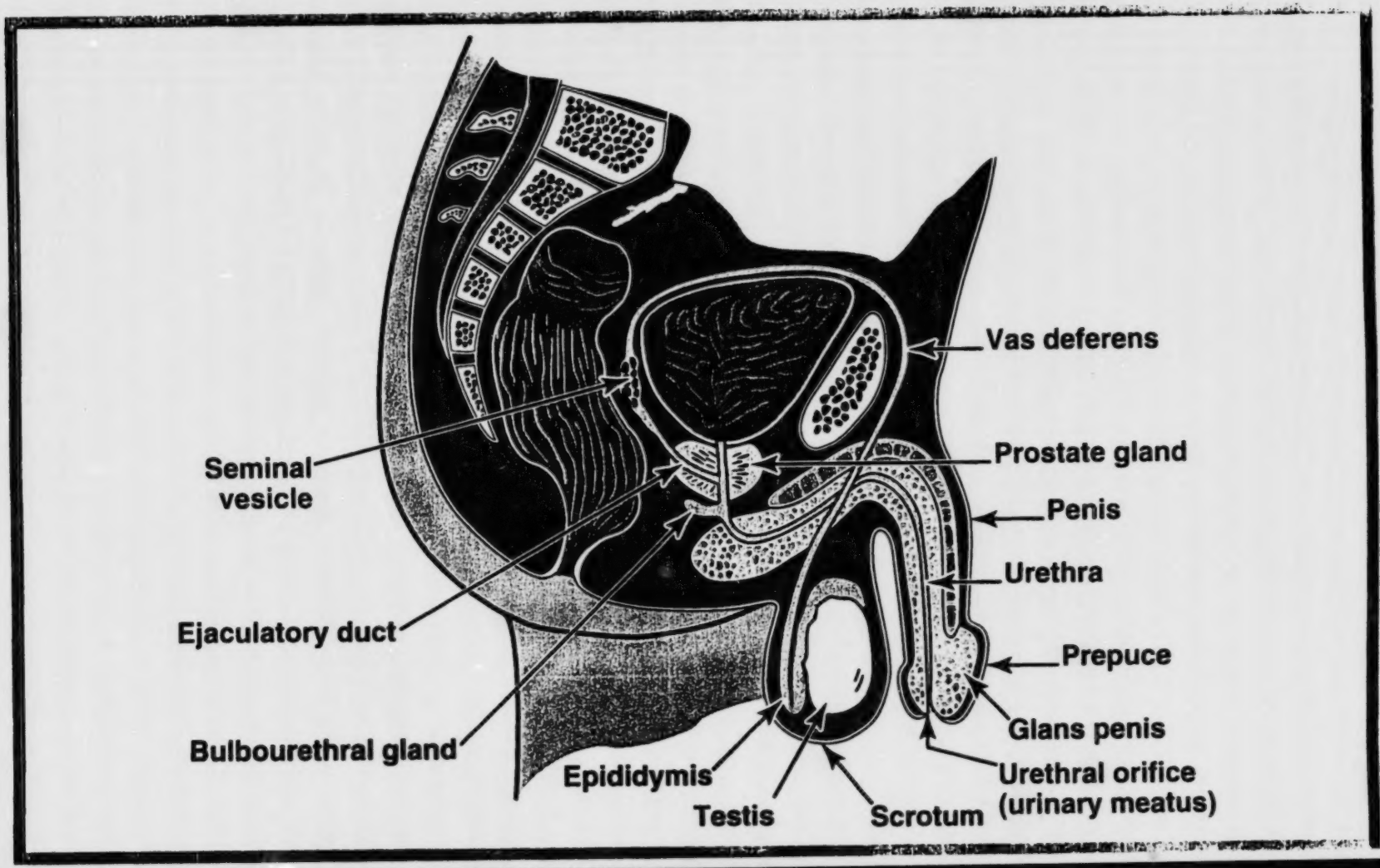
  The organization that sponsors this site is dedicated to providing clearinghouse-type information about prostate cancer.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

Male Reproductive System



Major Glands and Structures of the Male Reproductive System



Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *male reproductive system*. Write your answer on the blank lines provided beside the term below.

Male reproductive system _____

_____

Objective 2 State the functions of the male reproductive system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

Objective 3 Define the term *semen*. Write your answer on the blank lines provided beside the term below.

Semen _____

_____

_____

Objective 4 Define the major glands and structures of the male reproductive system. Write your answers on the blank lines provided beside each of the terms below and on the next page.

a. Scrotum _____

_____

b. Testis _____

_____

c. Epididymis _____

_____

_____

d. Vas deferens _____

e. Seminal vesicle _____

f. Ejaculatory duct _____

g. Prostate gland _____

h. Bulbourethral gland (Cowper's gland) _____

i. Urethra _____

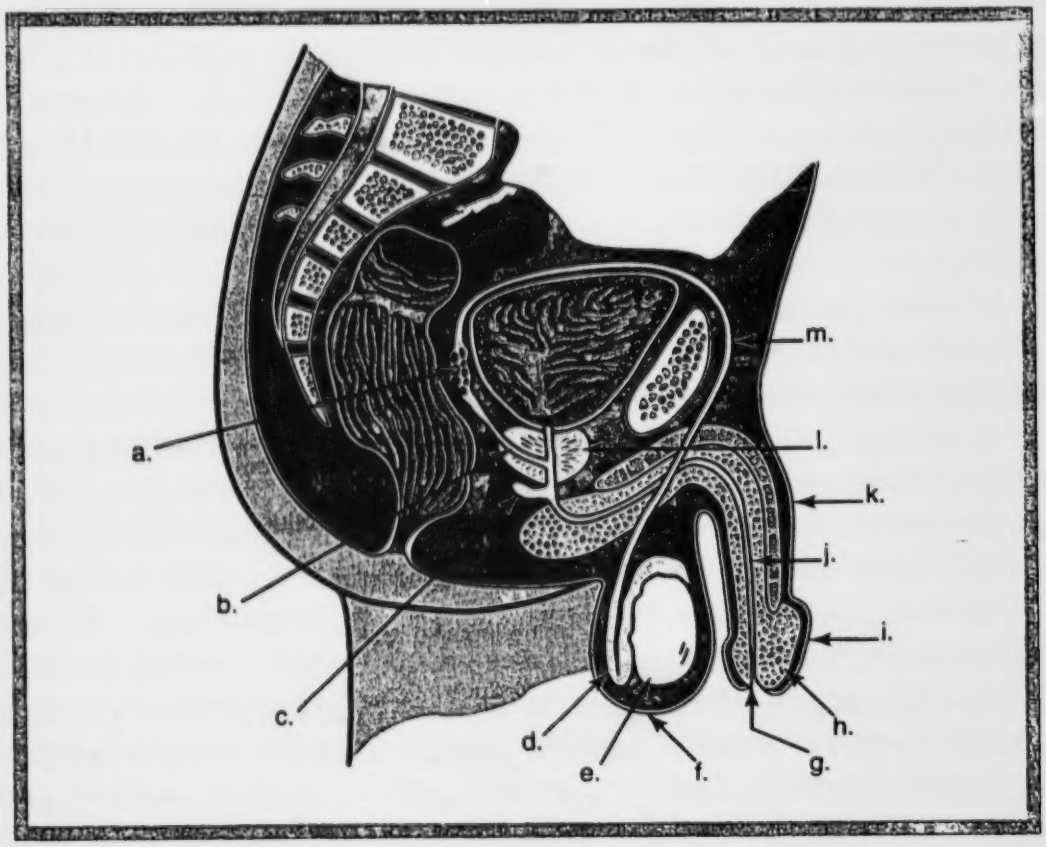
j. Penis _____

k. Glans penis _____

l. Prepuce _____

Objective 5

Label the major glands and structures of the male reproductive system. Write your answers on the blank lines provided below the following illustration.



a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

i. _____

j. _____

k. _____

l. _____

m. _____

Objective 6 Complete statements that describe the characteristics and structure of the scrotum. Write your answers on the blank lines provided in the statements below.

a. The scrotum is suspended from the _____ region; and the tissues of the scrotum are continuous with those of the _____ and _____.

b. The scrotum is divided by an _____ that creates a sac for each testis.

c. The location of the scrotum helps to maintain an environmental temperature that is favorable for _____ production.

Objective 7 Complete statements that describe the characteristics and structure of the testes. Write your answers on the blank lines provided in the statements below.

a. The testes are the primary male reproductive _____ glands.

b. The testes are egg-shaped glands located in the _____ and suspended from the inguinal region by the _____.

c. The testes produce _____ and secrete them as _____.

d. The testes also secrete the hormones _____ and _____ directly into the blood.

Objective 8 Complete statements that describe the characteristics and structure of the epididymis. Write your answers on the blank lines provided in the statements below.

a. The epididymis is a single, tightly coiled tube that lies along the sides and superior portion of the _____.

b. Though very small in diameter, the epididymis measures approximately _____ feet in length.

c. The epididymis connects the testes with the _____ and serves as one of the ducts through which sperm travels during ejaculation.

d. The epididymis stores _____ as it matures and secretes part of the _____.

Objective 9

Complete statements that describe the characteristics and structures of the vas deferens. Write your answers on the blank lines provided in the statements below.

a. The vas deferens is approximately _____ inches long.

b. The vas deferens passes into the abdominal cavity through the _____, where it is enclosed in the spermatic cord.

c. The vas deferens extends over the top of the posterior surface of the _____ and down to the _____, where it joins the corresponding seminal vesicle to form the ejaculatory duct.

d. The vas deferens serves as a passageway for _____.

Objective 10

Complete statements that describe the characteristics and structure of the seminal vesicles. Write your answers on the blank lines provided in the statements below.

a. The seminal vesicles are membranous, hollow pouches that lie obliquely between the _____ and the _____, posterior to the lower portion of the _____.

b. The seminal vesicles produce secretions that bathe, protect, and nourish _____.

c. The anterior portion of a seminal vesicle converges with a corresponding vas deferens to form an _____.

Objective 11

Complete statements that describe the characteristics and structure of the prostate gland. Write your answers on the blank lines provided in the statements below and on the next page.

a. The prostate gland is a single, globular gland that lies inferior to the _____ and surrounds the first section of the _____.

b. The prostate is composed of _____ tissue and is covered by a _____ capsule.

c. The prostate secretes a portion of the semen and an alkaline fluid that increases the _____ and _____ of the spermatozoa.

d. The prostate _____ during ejaculation of seminal fluid.

e. The prostate is the most-common site for _____ in the male reproductive system.

OBJECTIVE 12 Complete statements that describe the characteristics and structure of the bulbourethral glands. Write your answers on the blank lines provided in the statements below.

a. The bulbourethral glands are located one on each side of the membranous section of the _____.

b. A duct about _____ inch long connects the glands with the membranous portion of the urethra.

c. The glands produce an alkaline fluid that provides _____ for semen and counteracts the acids present in the male _____ and the female _____.

OBJECTIVE 13 Complete statements that describe the characteristics and structure of the penis. Write your answers on the blank lines provided in the statements below.

a. The penis is a cylindrical, pendulous organ suspended from the front and sides of the _____.

b. The penis contains the _____ and is the male copulatory organ by which male gametes are introduced into the female _____.

c. The penis is composed of three cylindrical masses of cavernous tissue bound together by fibrous tissue and covered with skin; the two lateral masses of the penis are called the _____, while the median mass is called the _____ because it contains the _____.

d. Erection of the penis is achieved by the _____ becoming filled with blood.

e. The skin covering the penis is a continuation of that covering the _____, _____, and _____.

OBJECTIVE 14

Describe the stages of development of the male reproductive organs. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

OBJECTIVE 15

Match common disorders and abnormalities of the male reproductive system to their correct definitions. Write the numbers on the blanks provided.

_____ a. The inability to reproduce

_____ b. Tightness of the prepuce of the penis that prevents the retraction of the foreskin over the glans penis

_____ c. A birth defect characterized by the testes failing to descend into the scrotum

_____ d. A sexually transmitted disease caused by the bacterium *Treponema pallidum* that is curable with penicillin but which can lead to serious and even fatal damage to the heart and nerves if not treated

_____ e. Swelling of the scrotum caused by structural abnormalities at birth or an accumulation of serous fluid in adults

_____ f. A sexually transmitted disease caused by the bacterium *Chlamydia trachomatis*; in men, the disease is characterized by urethritis or epididymitis while in women it may be asymptomatic or characterized by pelvic inflammation

_____ g. Cancer of the testes

_____ h. A sexually transmitted disease caused by the virus Herpes simplex and characterized by painful lesions

_____ i. The inability to achieve or maintain an erection to the point of ejaculation

_____ j. Enlargement of the prostate gland

_____ k. A sexually transmitted disease caused by the bacterium *Neisseria gonorrhoeae* and characterized in men by urethritis and pus in the urine, while often being asymptomatic in women

_____ l. Acute or chronic inflammation of the epididymis

_____ m. Cancer of the prostate gland

_____ n. Low sperm count

_____ o. A birth defect in which the urinary meatus is located on the underside of the penis

1. Chlamydial infection
2. Cryptorchidism
3. Epididymitis
4. Genital herpes
5. Gonorrhea
6. Hydrocele
7. Hypospadias
8. Impotence
9. Oligospermia
10. Phimosis
11. Prostate cancer
12. Prostatic hypertrophy
13. Sterility
14. Syphilis
15. Testicular cancer

Answers to Written Test

Objective 1

The male gonads, associated ducts and glands, and the external genitalia that function in the procreation of offspring

Objective 2

Answers may appear in any order.

a. Perpetuation of the human species
b. Sexual gratification
c. Secretion of hormones

Objective 3

Seminal fluid; the thick, sticky, whitish fluid of the male reproductive system that is discharged from the urethra on ejaculation and contains spermatozoa suspended in the secretions of the glands associated with the reproductive system

Objective 4

a. The pouch of skin that contains the testes

b. One of a pair of male reproductive glands that produces sperm and is contained within the scrotum at sexual maturity

c. A system of ductules emerging posteriorly from the testis that holds sperm and that unites into a single coiled duct that is continuous with the vas deferens

d. The thick-walled spermatic duct that begins at and is continuous with the tail of the epididymis and eventually joins the duct of a seminal vesicle to form the ejaculatory duct

e. Either of a pair of glandular pouches that lie on either side of the male reproductive tract and secrete a sugar- and protein-containing fluid into the ejaculatory duct

f. Either of the paired ducts that are formed by the junction of the duct from the seminal vesicle with the vas deferens and that pass through the prostate to empty into the urethra by means of a small opening

g. The chestnut-sized gland in men that surrounds the neck of the bladder and the urethra and produces a secretion that liquifies coagulated semen

h. Either of two small, pea-shaped glands located below the prostate gland and connecting with the urethra and discharging a fluid into the semen that is necessary for sperm viability

i. The tubular structure that in men serves as a passageway for semen during ejaculation and as a canal for urine during voiding

j. The external reproductive organ of a man

k. The cone-shaped tip of the penis that is composed of erectile tissue, encloses the urethra, and contains the urethral orifice, which is also called the *urinary meatus*

l. The foreskin; the fold of skin that forms the retractable cover of the glans penis

Objective 5

a. Seminal vesicle
b. Ejaculatory duct
c. Bulbourethral gland
d. Epididymis
e. Testis
f. Scrotum
g. Urethral orifice (urinary meatus)
h. Glans penis
i. Prepuce
j. Urethra
k. Penis
l. Prostate gland
m. Vas deferens

Objective 6

a. perineal; groin; perineum
b. internal septum
c. sperm

Objective 7

a. endocrine
b. scrotum; spermatic cord
c. spermatozoa; semen (seminal fluid)
d. testosterone; androsterone

Objective 8

a. testes
b. 20
c. vas deferens
d. sperm; seminal fluid

Objective 9

a. 18
b. inguinal canal
c. urinary bladder; prostate gland
d. sperm

Objective 10

a. bladder; rectum; bladder
b. spermatozoa
c. ejaculatory duct

Objective 11

a. bladder outlet; urethra
b. glandular; fibrous
c. motility; fertility
d. contracts
e. cancer

Objective 12

a. urethra
b. 1
c. lubrication; urethra; vagina

Objective 13

a. pubic arch
b. urethra; vagina
c. corpora cavernosa penis; corpus cavernosum urethra; urethra
d. venous spaces
e. pubis; scrotum; perineum

Objective 14

a. For approximately the first two months of embryonic life, no structural sexual differentiation is evident, though by the end of the third month, the sex of the fetus is clearly distinguishable.

b. At birth, the testes contain thousands of spermatocytes.

c. From birth until the onset of puberty, the male reproductive organs grow with the rest of the body but are not functional.

d. With the onset of puberty, the male reproductive system begins producing functional spermatozoa and the body exhibits the secondary sex characteristics.

Objective 15

a. 13	d. 14	g. 15	j. 12	m. 11
b. 10	e. 6	h. 4	k. 5	n. 9
c. 2	f. 1	i. 8	l. 3	o. 7

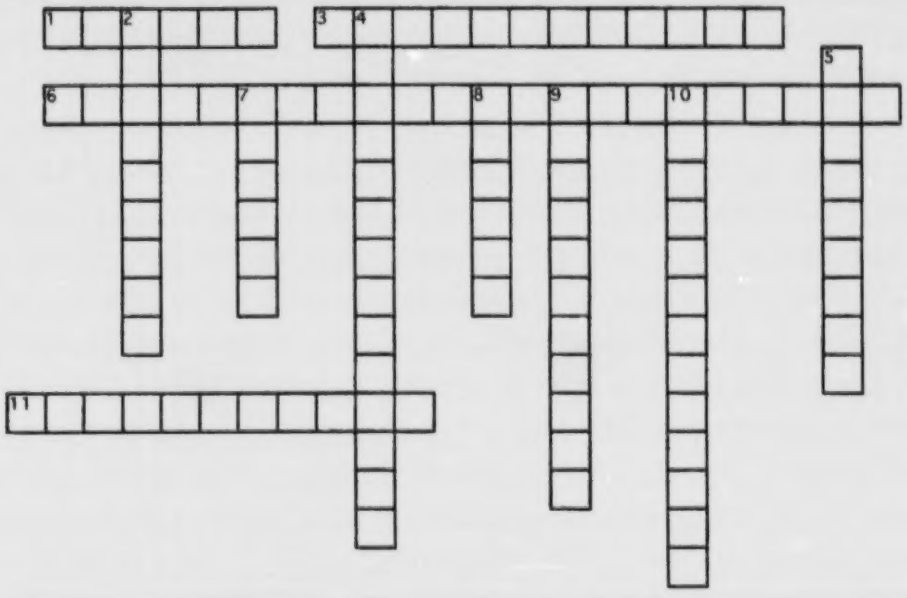
Answers to Assignment Sheet

Assignment Sheet 1

Answers must be evaluated to the satisfaction of the instructor according to the topic assigned.

Crossword Puzzle 1—Terms from Objectives 1 and 2

Name _____ Date _____



ACROSS

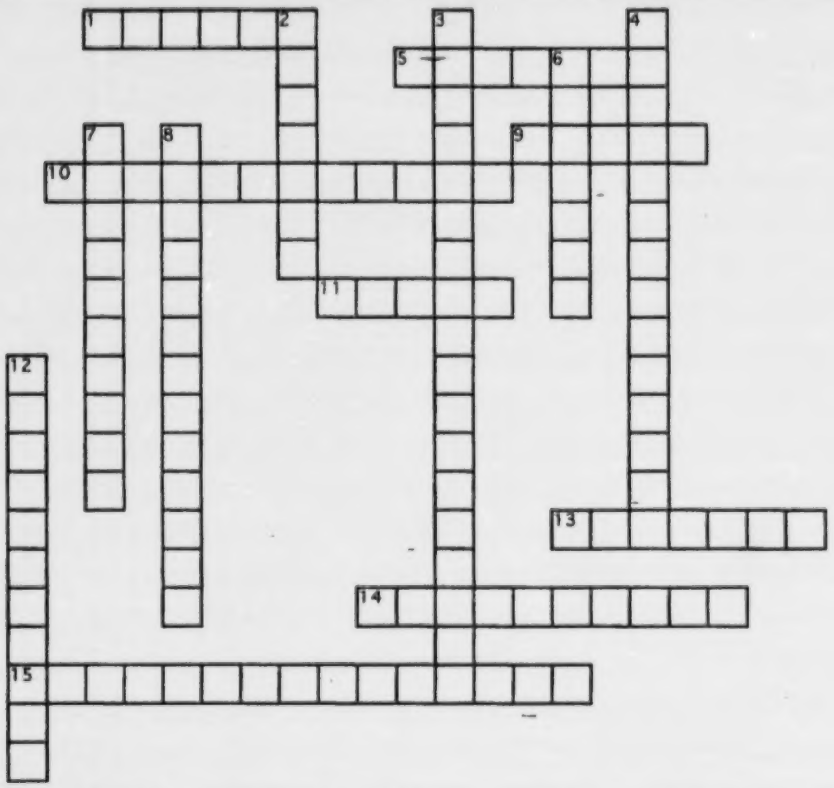
1. A mature male or female germ cell; the spermatozoon in a male
3. _____ characteristics of the male include (1) an increase in the size of the larynx, resulting in a lower pitch of the voice; (2) rapid growth of external genitalia; (3) development of hair on the face, pubis, axilla, and other parts of the body; and (4) development of firmer musculature, broad shoulders, and narrow hips (2 words)
6. The male gonads, associated ducts and glands, and the external genitalia that function in the procreation of offspring (3 words)
11. The sudden emission of semen from the male urethra

DOWN

2. The reproductive gland in a male that produces gametes; a testis (2 words)
4. Areas of the body that are sensitive to sexual stimulation (2 words)
5. The organs of the reproductive system and the associated structures of either sex
7. The condition of a female mammal in which she is sexually excited, will accept a mate, and is capable of becoming pregnant
8. The peak of sexual excitement, accompanied by near convulsive physical and emotional responses, including ejaculation in the male
9. Sexual union; the sexual mating of a male and female
10. Sexual excitement as a result of mental, visual, or tactile stimulation (2 words)

Crossword Puzzle 2—Terms from Objectives 3 and 4

Name _____ Date _____



ACROSS

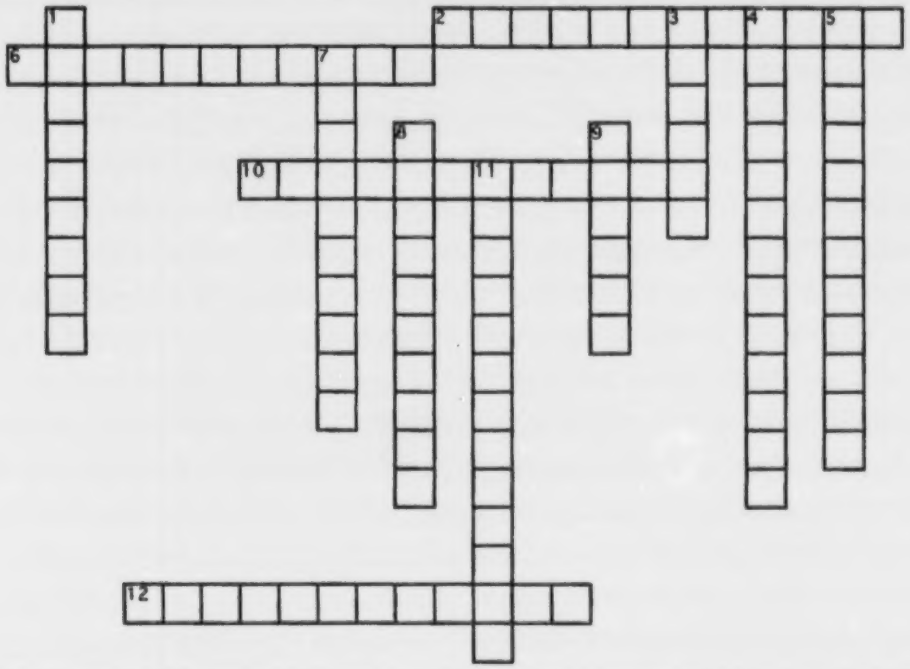
1. One of a pair of male reproductive glands that produces sperm and is contained within the scrotum at sexual maturity
5. A small duct
9. The external reproductive organ of a man
10. A mature male germ cell that develops in the testes and resembles a tadpole with a head containing a nucleus, a neck, and a tail that provides propulsion
11. Seminal fluid; the thick, sticky, whitish fluid of the male reproductive system that is discharged from the urethra on ejaculation and contains spermatozoa suspended in the secretions of the glands associated with the reproductive system
13. The foreskin; the fold of skin that forms the retractable cover of the glans penis
14. The cone-shaped tip of the penis that is composed of erectile tissue, encloses the urethra, and contains the urethral orifice, which is also called the *urinary meatus* (2 words)
15. Either of the paired ducts that are formed by the junction of the duct from the seminal vesicle with the vas deferens and that pass through the prostate to empty into the urethra by means of a small opening (2 words)

DOWN

2. The pouch of skin that contains the testes
3. Either of two small, pea-shaped glands located below the prostate gland and connecting with the urethra and discharging a fluid into the semen that is necessary for sperm viability; also called *Cowper's gland* (2 words)
4. Either of a pair of glandular pouches that lie on either side of the male reproductive tract and secrete a sugar- and protein-containing fluid into the ejaculatory duct (2 words)
6. The tubular structure that in men serves as a passageway for semen during ejaculation and as a canal for urine during voiding
7. A system of ductules emerging posteriorly from the testis that holds sperm and that unites into a single coiled duct that is continuous with the vas deferens
8. The chestnut-sized gland in men that surrounds the neck of the bladder and the urethra and produces a secretion that liquifies coagulated semen (2 words)
12. The thick-walled spermatic duct that begins at and is continuous with the tail of the epididymis and eventually joins the duct of a seminal vesicle to form the ejaculatory duct (2 words)

Crossword Puzzle 3—Terms from Objectives 6 Through 9

Name _____ Date _____



ACROSS

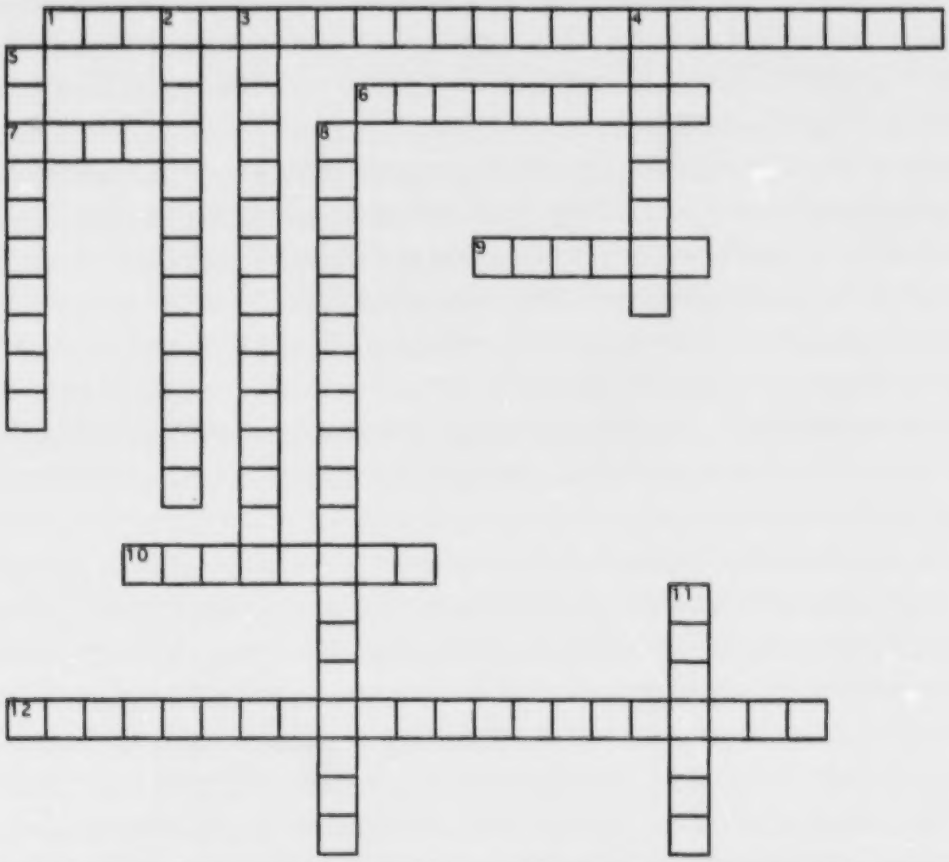
2. An immature sperm cell
6. The approximately 18-inch-long duct that serves as a passageway for sperm (2 words)
10. A male sex hormone found in human male and female urine
12. A surgical means of contraception for women; removal of the uterus

DOWN

1. A surgical means of contraception for men
3. The primary male reproductive endocrine glands; egg-shaped glands located in the scrotum and suspended from the inguinal region by the spermatic cord; produce spermatozoa and secrete them as semen (seminal fluid); also secrete the hormones testosterone and androsterone directly into the blood
4. Conscious efforts to prevent pregnancy
5. The male hormone that stimulates the development of the secondary sexual characteristics
7. A single, tightly coiled tube that lies along the sides and superior portion of the testes; measures approximately 20 feet in length; connects the testes with the vas deferens and serves as one of the ducts through which sperm travels during ejaculation; stores sperm as it matures; and secretes part of the seminal fluid
8. The act of creating an embryo through sexual intercourse
9. Against
11. A surgical means of contraception for women; severing of the fallopian tubes (2 words)

Crossword Puzzle 4—Terms from Objectives 10 Through 14

Name _____ Date _____



ACROSS

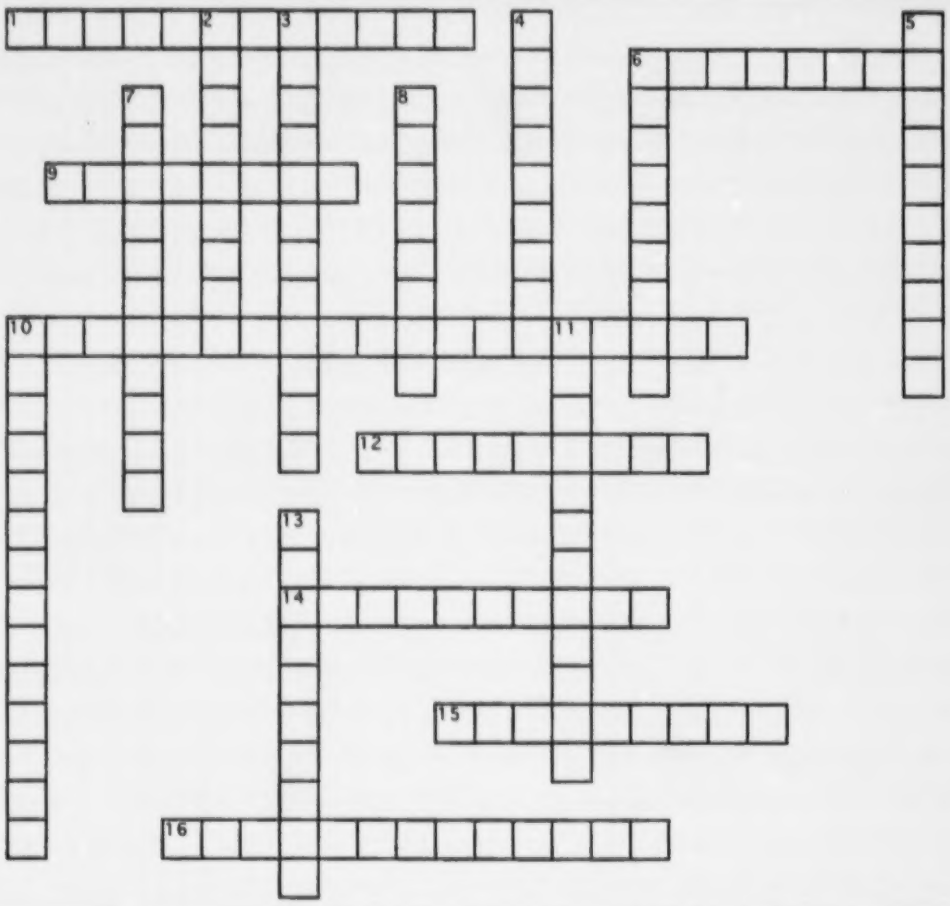
1. The median mass of the penis containing the urethra (3 words)
6. The capacity to reproduce
7. A cylindrical, pendulous organ suspended from the front and sides of the pubic arch; contains the urethra and is the male copulatory organ by which male gametes are introduced into the female vagina; and is composed of three cylindrical masses of cavernous tissue bound together by fibrous tissue and covered with skin
9. A mature male or female germ cell containing the chromosome set capable of initiating the formation of a new person by fusion with the gamete of the opposite sex
10. The _____ is composed of glandular tissue and is covered by a fibrous capsule; secretes a portion of the semen and an alkaline fluid that increases the motility and fertility of the spermatozoa; and contracts during ejaculation of seminal fluid
12. The two lateral masses of the penis (3 words)

DOWN

2. A single, globular gland that lies inferior to the bladder outlet and surrounds the first section of the urethra (2 words)
3. Membranous, hollow pouches that lie obliquely between the bladder and the rectum, posterior to the lower portion of the bladder and produce secretions that bathe, protect, and nourish spermatozoa (2 words)
4. The ability to move
5. Related to sexual intercourse or copulation
8. The _____ are located one on each side of the membranous section of the urethra and produce an alkaline fluid that provides lubrication for semen and counteracts the acids present in the male urethra and the female vagina (2 words)
11. The stage in life for both genders in which the individual becomes sexually mature and capable of reproduction

Crossword Puzzle 5—Terms from Objective 15

Name _____ Date _____



ACROSS

1. Low sperm count
6. _____ cancer is cancer of the prostate gland
9. A sexually transmitted disease caused by the bacterium *Treponema pallidum* that is curable with penicillin but which can lead to serious and even fatal damage to the heart and nerves if not treated
10. A sexually transmitted disease caused by the bacterium *Chlamydia trachomatis*; in men, the disease is characterized by urethritis or epididymitis while in women it may be asymptomatic or characterized by pelvic inflammation (2 words)
12. Swelling of the scrotum caused by structural abnormalities at birth or an accumulation of serous fluid in adults
14. A birth defect in which the urinary meatus is located on the dorsal or topside of the penis
15. A sexually transmitted disease caused by the bacterium *Neisseria gonorrhoeae* and characterized in men by urethritis and pus in the urine, while often being asymptomatic in women
16. A sexually transmitted disease caused by the virus *Herpes simplex* and characterized by painful lesions (2 words)

DOWN

2. The inability to reproduce
3. Acute or chronic inflammation of the epididymis
4. The inability to achieve or maintain an erection to the point of ejaculation
5. _____ cancer is cancer of the testes
6. Enlargement of the prostate gland is called _____ *hypertrophy*
7. A birth defect in which the urinary meatus is located on the underside of the penis
8. Tightness of the prepuce of the penis that prevents the retraction of the foreskin over the glans penis
10. A birth defect characterized by the testes failing to descend into the scrotum
11. A surgical procedure in which the prepuce of the penis is excised
13. Inflammation of the urethra

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
1. GAMETE
3. SECONDARY SEX
6. MALE REPRODUCTIVE SYSTEM
11. EJACULATION

DOWN
2. MALE GONAD
4. EROGENOUS ZONES
5. GENITALIA
7. ESTRUS
8. CLIMAX
9. INTERCOURSE
10. SEXUAL AROUSAL

Crossword Puzzle 2

ACROSS
1. TESTIS
5. DUCTULE
9. PENIS
10. SPERMATOZOON
11. SEMEN
13. PREPUCE
14. GLANS PENIS
15. EJACULATORY DUCT

DOWN
2. SCROTUM
3. BULBOURETHRAL GLAND
4. SEMINAL VESICLE
6. URETHRA
7. EPIDIDYMIS
8. PROSTATE GLAND
12. VAS DEFERENS

Crossword Puzzle 3

ACROSS
2. SPERMATOCYTE
6. VAS DEFERENS
10. ANDROSTERONE
12. HYSTERECTOMY

DOWN
1. VASECTOMY
3. TESTES
4. CONTRACEPTION
5. TESTOSTERONE
7. EPIDIDYMIS
8. CONCEPTION
9. CONTRA
11. TUBAL LIGATION

Crossword Puzzle 4

ACROSS
1. CORPUS CAVERNOSUM URETHRA
6. FERTILITY
7. PENIS
9. GAMETE
10. PROSTATE
12. CORPORA CAVERNOSA PENIS

DOWN
2. PROSTATE GLAND
3. SEMINAL VESICLES
4. MOTILITY
5. COPULATORY
8. BULBOURETHRAL GLANDS
11. PUBERTY

Crossword Puzzle 5

ACROSS

1. OLIGOSPERMIA
6. PROSTATE
9. SYPHILIS
10. CHLAMYDIAL INFECTION
12. HYDROCELE
14. EPISPADIAS
15. GONORRHEA
16. GENITAL HERPES

DOWN

2. STERILITY
3. EPIDIDYMITIS
4. IMPOTENCE
5. TESTICULAR
6. PROSTATIC
7. HYPOSPADIAS
8. PHIMOSIS
10. CRYPTORCHIDISM
11. CIRCUMCISION
13. URETHRITIS

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 15

1. _____ is a birth defect characterized by the testes failing to descend into the scrotum.
   a. Cryptorchidism
   b. Phimosis
   c. Hypospadias
   d. Epispadias

Objective 2

2. Which of the following is NOT a function of the reproductive system?
   a. replacement of dead cells
   b. perpetuation of the human species
   c. sexual gratification
   d. secretion of hormones

Objective 10

3. The seminal vesicles produce secretions that _____ the spermatozoa.
   a. bathe
   b. nourish
   c. both "a" and "b"
   d. neither "a" nor "b"

Objective 7

4. The testes are the primary _____.
   a. source of estrogen
   b. site for cancer in the male reproductive system
   c. male reproductive endocrine glands
   d. male reproductive ductless glands

Objective 2

5. Which of the following is NOT a male secondary sexual characteristic?

   a. a decrease in the size of the larynx, resulting in a lower pitch of the voice

   b. rapid growth of external genitalia

   c. development of hair on the face, pubis, axilla, and other parts of the body

   d. development of firmer musculature, broad shoulders, and narrow hips

Objective 7

6. The testes are located in the _____ suspended from the inguinal region by the _____.

   a. scrotum; spermatic cord

   b. penis; vas deferens

   c. epididymis; ejaculatory duct

   d. prostate gland; seminal vesicle

Objective 13

7. The penis is composed of three cylindrical masses of _____ and covered with skin.

   a. cavernous tissue bound together by fibrous tissue

   b. fibrous tissue bound together by cavernous tissue

   c. muscle tissue, fibrous tissue, and connective tissue

   d. vascular tissue bound together by connective tissue

Objective 3

8. Another term for seminal fluid is _____.

   a. spermatozoon

   b. semen

   c. epididymis

   d. prepuce

Objective 6

9. Which of the following statements describe how the testes are located in the scrotum?

   a. The scrotum is a single pouch with both testes contained in that pouch.

   b. The scrotum is a single pouch with an internal septum so that there is a sac for each testis on each side of the septum.

   c. The scrotum is two separate pouches with an outer covering and one testis in each pouch.

   d. The scrotum is two separate pouches with separate coverings and one testis in each pouch.

Objective 4

10. The _____ are contained within the scrotum at sexual maturity.

    a. epididymis

    b. vas deferens

    c. testes

    d. seminal vesicles

Objective 8

11. The epididymis measures approximately _____ in length.

    a. 2 inches

    b. 4 inches

    c. 2 feet

    d. 20 feet

Objective 11

12. The prostate is composed of _____ tissue and is covered by a _____ capsule.

    a. muscle; membranous

    b. membranous; muscle

    c. fibrous; glandular

    d. glandular; fibrous

Objective 4

13. The _____ is the gland that surrounds the neck of the bladder and the urethra and produces a secretion that liquifies coagulated semen.

    a. bulbourethral gland

    b. seminal vesicles

    c. glans penis

    d. prostate gland

Objective 15

14. Prostatic hypertrophy is _____.

    a. inflammation of the epididymis

    b. enlargement of the prostate gland

    c. cancer of the prostate gland

    d. excessive secretions of the prostate gland

Objective 7

15. The testes produce _____ and secrete them as semen.

    a. spermatocytes
    b. spermatozoa
    c. protozoa
    d. leukocytes

Objective 5

16. The structure indicated by the letter "W" in the illustration on the next page is the _____.

    a. vas deferens
    b. prepuce
    c. glans penis
    d. prostate gland

Objective 5

17. The structure indicated by the letter "X" in the illustration on the next page is the _____.

    a. glans penis
    b. scrotum
    c. testis
    d. epididymis

Objective 5

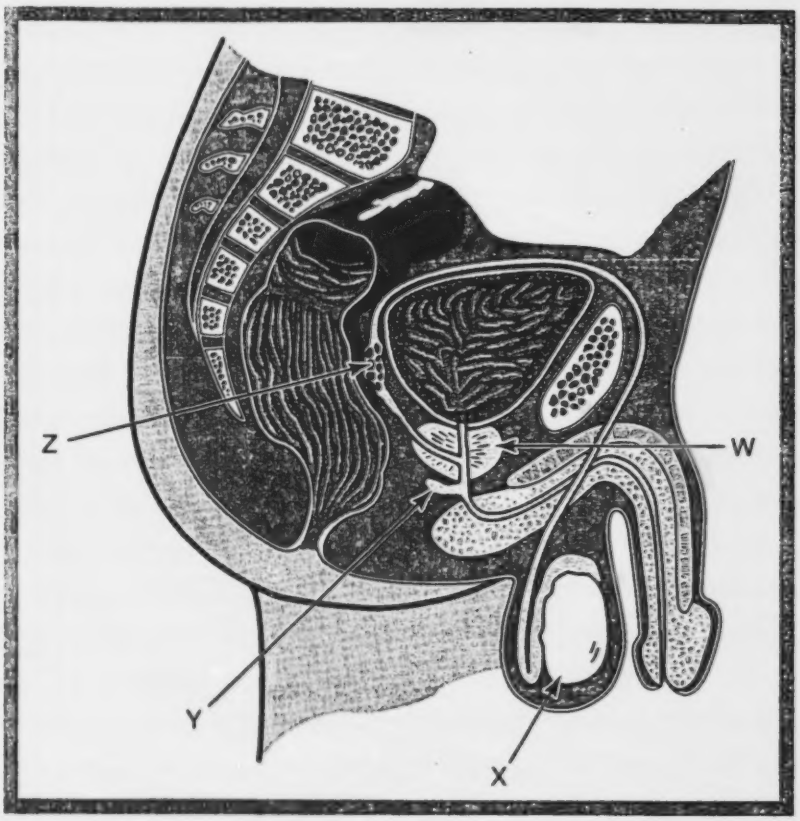
18. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

    a. seminal vesicle
    b. bulbourethral gland
    c. epididymis
    d. testis

Objective 5

19. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

    a. seminal vesicle
    b. bulbourethral gland
    c. epididymis
    d. testis



Objective 15

20. _____ is a sexually transmitted disease caused by the bacterium *Treponema pallidum* that is curable with penicillin but which can lead to serious and even fatal damage to the heart and nerves if not treated.

a. Gonorrhea

b. Genital herpes

c. Syphilis

d. Chlamydial infection

Objective 6

21. The anatomy and physiology of the scrotum primarily serve to _____.

a. protect the testes from physical injury

b. distinguish the male from the female

c. maintain an environmental temperature that is favorable for sperm production

d. increase the volume of blood circulating around the testes

Objective 9

22. Which of the following statements is NOT correct with regard to the vas deferens?

    a. The vas deferens is a thick-walled continuation of the epididymis approximately 18 feet long.

    b. The vas deferens passes into the abdominal cavity through the inguinal canal, where it is enclosed in the spermatic cord.

    c. The vas deferens extends over the top of the posterior surface of the urinary bladder and down to the prostate gland, where it joins the corresponding seminal vesicle to form the ejaculatory duct.

    d. The vas deferens serves as a passageway for sperm.

Objective 3

23. The average ejaculation contains _____ cubic centimeters.

    a. 3 to 5

    b. 6 to 8

    c. 10 to 12

    d. 14 to 16

Objectives 4 & 12

24. Which of the following is NOT a correct statement about the bulbourethral glands?

    a. The glands are two pea-sized glands.

    b. The glands are located on each side of the membranous portion of the urethra.

    c. A duct about 1-inch long connects the glands with the membranous portion of the urethra.

    d. The glands produce an acidic secretion.

Objective 6

25. The tissues of the scrotum are continuous with those of the _____.

    a. groin and perineum

    b. legs and abdomen

    c. rectum and abdomen

    d. legs and perineum

Objective 10

26. The anterior portion of a seminal vesicle converges with a corresponding _____ to form the _____.

    a. vas deferens; ejaculatory duct

    b. ejaculatory duct; vas deferens

    c. epididymis; spermatic cord

    d. spermatic cord; epididymis

Objective 13

27. The skin covering the penis is a continuation of that covering the _____.

    a. pubis

    b. scrotum

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 7

28. Which of the following hormones is secreted by the testes?

    a. testosterone

    b. estrogen

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 14

29. For approximately the first _____ months of embryonic life in the development of the reproductive organs, no structural sexual differentiation is evident.

    a. two

    b. three

    c. four

    d. five

Objective 8

30. The epididymis is a single, tightly coiled tube that connects the _____ with the _____.

    a. testes; ejaculatory duct

    b. vas deferens; ejaculatory duct

    c. testes; vas deferens

    d. vas deferens; inguinal canal

Objective 3

31. One cubic centimeter of semen contains approximately _____ sperm.

    a. 70 to 100

    b. 70 to 100 thousand

    c. 70 to 100 million

    d. 70 to 100 billion

Objective 10

32. The seminal vesicles lie _____.

    a. obliquely between the bladder and the rectum, anterior to the lower portion of the bladder

    b. obliquely between the bladder and the rectum, posterior to the lower portion of the bladder

    c. lateral to the bladder and the rectum, anterior to the upper portion of the bladder

    d. lateral to the bladder and the rectum, posterior to the upper portion of the bladder

Objective 14

33. From birth until _____, the male reproductive organs grow with the rest of the body but are not functional.

    a. age 6

    b. age 18

    c. the onset of puberty

    d. first intercourse

Objective 1

34. The _____ consists of the gonads, ducts and glands, and external genitalia that function in the procreation of offspring.

    a. male reproductive system

    b. male hormone system

    c. secondary sex characteristics

    d. vas deferens

Objective 11

35. The prostate gland is a single, globular gland that lies _____ to the bladder outlet and surrounds the _____ section of the urethra.

    a. inferior; first

    b. inferior; middle

    c. superior; first

    d. superior; middle

Objective 13

36. The two lateral masses of the penis are the _____.

a. cavernosa corpora penis

b. cavernosum corpora urethra

c. corpora cavernosum urethra

d. corpora cavernosa penis

Objective 4

37. The glans penis is composed of _____ tissue and contains the _____.

a. muscular; urethral orifice

b. fibrous; urinary meatus

c. erectile; urethral orifice

d. sperm-producing; urinary meatus

Objective 14

38. Male reproductive organs may remain functional _____.

a. until age 50

b. until age 60

c. until age 65

d. throughout a natural lifespan

Objective 11

39. The prostate secretes an _____ fluid that increases the _____ of the spermatozoa.

a. alkaline; fertility

b. acidic; motility

c. acidic; fertility

d. alkaline; fertility and motility

Objective 3

40. Semen is a thick, sticky, white fluid consisting of sperm and the secretions of the male reproductive organs and is discharged during _____.

a. vasectomization

b. dissemination

c. ejaculation

d. testiculation

Objective 15

41. The inability to reproduce is called _____.

    a. *sterility*
    b. *oligospermia*
    c. *impotence*
    d. *incontinence*

Objective 12

42. The fluid from the bulbourethral glands _____.

    a. provides lubrication for the semen
    b. counteracts the alkalines present in the male urethra
    c. both "a" and "b"
    d. neither "a" nor "b"

Objective 13

43. The penis contains the urethra and is the male copulatory organ by which male _____.

    a. spermatocytes are stored
    b. gametes are introduced into the female vagina
    c. spermatocytes are allowed to mature into spermatozoa
    d. spermatozoa are allowed to mature into spermatocytes

Objective 9

44. Which of the following are forms of contraception?

    a. abstinence
    b. condoms
    c. both "a" and "b"
    d. neither "a" nor "b"

Objective 2

45. The sexual mating of a male and female is called _____.

    a. *estrus*
    b. *sexual arousal*
    c. *ejaculation*
    d. *intercourse*

Objective 13

46. Erection of the penis is achieved by the venous spaces becoming filled with _____.

a. blood

b. urine

c. seminal fluid

d. secretions from the Cowper's glands

Objective 15

47. Swelling of the scrotum caused by structural abnormalities at birth or an accumulation of serous fluid in adults is called _____.

a. *scrotitis*

b. *phimosis*

c. *scrotal hypertrophy*

d. *hydrocele*

Objective 4

48. The two ejaculatory ducts are short tubes that pass through the prostate gland, where they empty into the _____.

a. urethra

b. prepuce

c. bladder

d. seminal vesicle

Objective 7

49. The male hormone that stimulates the development of secondary sexual characteristics is _____.

a. androsterone

b. testosterone

c. both "a" and "b"

d. neither "a" nor "b"

Objective 14

50. At birth, the testes contain thousands of _____.

a. testicles

b. seminal cells

c. spermatozoa

d. spermatocytes

Answers to Module Review

1. a	11. d	21. c	31. c	41. a
2. a	12. d	22. a	32. b	42. a
3. c	13. d	23. a	33. c	43. b
4. c	14. b	24. d	34. a	44. c
5. a	15. b	25. a	35. a	45. d
6. a	16. d	26. a	36. d	46. a
7. a	17. c	27. c	37. c	47. d
8. b	18. b	28. a	38. d	48. a
9. b	19. a	29. a	39. d	49. b
10. c	20. c	30. c	40. c	50. d

MODULE SET II:
Major Body Systems

Module 15: Reproductive System—Female

Module Contents

COMPONENTS

	Page
Suggested Activities	3
Transparency Masters	
1—Female Reproductive System	7
2—Major Internal Organs and Structures of the Female Reproductive System	9
3—Major Structures and Substructures of the Internal Female Reproductive System	11
4—Major Structures of the External Female Reproductive System	13
5—Major Structures of a Breast (Lateral View)	15
6—Follicle and Corpus Luteum	17
7—Phases of the Menstrual Cycle	19
Written Test	21
Answers to Written Test	41
Answers to Assignment Sheet	47
Crossword Puzzles	
1—Terms from Objectives 1 Through 4	49
2—Terms from Objectives 5 Through 9	51
3—Terms from Objectives 10 and 11	53
4—Terms from Objective 12	55
5—Terms from Objectives 15 Through 17	57
6—Terms from Objective 18	59
7—Terms from Objectives 19 and 20	61
8—Terms from Objectives 21 Through 23	63
9—Terms from Objectives 24 and 25	65
10—Terms from Objective 26	67
11—Terms from Objective 26 (cont.)	69
Answers to Crossword Puzzles	71
Module Review	75
Answers to Module Review	101

Suggested Activities

INSTRUCTIONAL PLAN

The following is a step-by-step instructional plan (preparation, delivery/application, and evaluation) to assist you in preparing for group instruction or to assist you in modifying the Learning Activity Sheet provided in the student edition for this module.

PREPARATION

- Review the module in the student edition.
- Review the Teaching Suggestions section that follows on page 4 of the Suggested Activities.
- Review the Resources Used in Developing This Module section that follows on page 5 of the Suggested Activities.
- Review the Suggested Web Sites section that follows on page 6 of the Suggested Activities.
- Review the additional resources that follow: transparency masters, Written Test, crossword puzzles, and Module Review.
- Review and obtain films, videotapes, and other resources you may want to use to supplement the instruction of this module.
- Develop your instructional plan. Adjust your instructional plan for different learning styles and for students with special needs.
- Make transparencies from the transparency masters.
- Select web sites to be inserted on the Learning Activities Sheet in the student edition.
- Select additional activities to be inserted on the Learning Activities Sheet in the student edition.
- Copy the Written Test, crossword puzzles, and Module Review for distribution to your students.
- Prepare supplemental resources for use by your students.

DELIVERY AND APPLICATION

- Provide the students with the module of instruction in the student edition.
- Discuss the specific objectives on the Module Objective Sheet.
- Discuss the Information Sheet. Implement your instructional plan to localize, supplement, and personalize the objectives presented in this portion of the module. Reinforce the basic academic and workplace skills when applicable.

EVALUATION

- Give the Written Test. Reteach and retest as required.

- Review with students the remaining section in the student edition: assignment sheet.
- Have students complete the assignment sheet.
- Give the Module Review.
- Compile the Written Test, assignment-sheet, and Module Review scores, and include any additional assignments or supplemental activities you have selected as part of your instructional plan.
- Reteach and retest as required.

TEACHING SUGGESTIONS

✔ **NOTE:** This module focuses on the anatomy and physiology of the female reproductive system. However, the module also addresses pregnancy and human development and provides some information on genetics. The organization of the module allows you to expand or condense any of these topics as appropriate for your course. For example, you may want to go into more detail about fetal development, the appearance of the fetus at weekly intervals, etc. You may want to explore dominant and recessive traits. The module contains objectives that address these and other related topics that you can expand to meet your training goals.

- Use crossword puzzles 1 through 11 to help reinforce the terms in the associated objectives.
- Use the following strategies to introduce the module and to supplement your discussion of Objective 1 through Objective 14.
  - — Ask the students to recall the functions of the male reproductive system and then to compare to those listed for the female reproductive system. They are the same except for support of the fetus. The students have previously studied fetal circulation and should be able to discuss ways in which the mother's systems support the fetus. Ask the students to name others besides those related to blood circulation.
  - — Use illustrations and models as well as other aids to discuss the components of the female reproductive system, including the external genitalia. This is another opportunity to make comparisons to the male reproductive system. Help the students understand how these components are comparable and how they develop from the fetal stage.
  - — Discuss the functions of the components overall and then focus on individual organs. For example, when discussing the uterus, ensure that the students understand that the uterus is suspended and why that is so. Point out the relationship of the uterine tubes and other structures. Then relate the overall structure to normal and abnormal positioning of the uteruses. Discuss Pap smears and other diagnostic procedures. Follow a similar approach in discussing the ovaries, vagina, and external genitalia.
- To supplement your discussion of Objective 15 and Objective 16, which describe the characteristics and stucture of the human breast, obtain mammograms showing normal and abnormal results and allow the students to witness a mammography. Invite a proponent of breast-feeding to address the class about nursing, colostrum, and other related topics.
- When discussing Objective 17, build on what the students already know about the development of the male reproductive system to discuss the development of the female

reproductive system. The primary differences are in the secondary sexual characteristics and the occurrence of menopause in women.

- Use the following strategies to supplement your discussion of the menstrual cycle, irregularities of the menstrual cycle, and surgical menopause, as presented in Objective 18 through Objective 20.

  — Use diagrams and other graphics to discuss the menstrual cycle. Make sure that the students understand the associated terms, including menses, menstruation, menstrual, etc. Explain in detail what is happening at each stage of the cycle. Help female students to relate these events with what they have experienced while menstruating. Ensure that students recognize two terminations of menstruation: pregnancy or completion of the cycle. Discuss contraceptives and the physiological effects of oral contraceptives.

  — Discuss abnormalities in menstruation. Emphasize that abnormalities may or may not be significant—that is, abnormalities may occur due to diet, fatigue, emotional situations, stress, or minor illness or they may be an indication of a serious problem.

  — Discuss surgical menopause and normal menopause. Discuss hormonal therapies.

- Use the following strategies to supplement your discussion of Objective 21 through Objective 25.

  — Discuss pregnancy and fetal development. A number of good media programs and other aids, such as the Public Broadcasting System *The Miracle of Life,* exist and can be used to supplement this discussion. Allow the students to study sonograms of fetuses and perform ultrasounds if practical. Discuss and demonstrate amniocentesis. Invite a surgeon or other guest to discuss the latest techniques for performing corrective surgery on fetuses for genetic defects and developmental problems.

  — Discuss abnormal births, including multiple births. Discuss C-sections and other interventions for abnormal births. Discuss induced deliveries. Invite an obstetrician to discuss considerations in induced delivery and C-sections. Have the students attend a Lamaze class.

  — Discuss genetics to the extent appropriate for your course. As a minimum, help students to understand the concepts of dominant and recessive genes.

- Objective 26 defines the common disorders and abnormalities of the female reproductive system. Invite an OB/GYN doctor to your class and ask him or her to provide art, posters, video, etc., that illustrate procedures used when these disorders/abnormalities occur.

RESOURCES USED IN DEVELOPING THIS MODULE

- *Anatomy and Physiology.* Stillwater, OK: Mid-America Vocational Curriculum Consortium, Inc., 1993.
- *Core Curriculum for Surgical Technology,* 4th ed. Englewood, CO: Association of Surgical Technologists, Inc., 1996.
- Gylys, Barbara A., and Regina Masters. *Medical Terminology Simplified,* 2nd ed. Philadelphia: F. A. Davis Company, 1998.
- Gray, Henry. *Gray's Anatomy,* 15th ed. New York: Gramery Books, 1977.

- Kwon-Chung, K. J., and John E. Bennett. *Medical Mycology.* Philadelphia, PA: Lea and Febiger, 1992.
- Scanlon, Valerie C. *Essentials of Anatomy and Physiology,* 3rd ed. Philadelphia: F. A. Davis Company, 1999.
- Sherris, David A., and Eugene B. Kern. *Basic Surgical Skills.* Rochester, MN: Mayo Foundation for Medical Education and Research, 1999.
- Thibodeau, Gary A., and Kevin T. Patton. *Anatomy and Physiology,* 4th ed. St. Louis: Mosby, Inc., 1999.

SUGGESTED WEB SITES*

✔ **NOTE:** The following web sites offer information about the female reproductive system and related topics such as pregnancy and fetal development.

- http://www.healthanswers.com

  This site addresses menstruation and pregnancy, focusing on the health issues for the child and mother.

- http://www.familyinternet.com/pregcom/index.htm

  This site also focuses on pregnancy and fetal development.

- http://www.med.upenn.edu/meded/public/berp/overview/BV_1.html

  This site provides good slides and graphics related to embryonic development.

- http://www.childbirth.org/

  This site addresses most of the topics in the module, from female-reproductive anatomy to menstruation and fertilization to pregnancy and delivery.

- http://www.yale.edu/ynhti/curriculum/units/1983/7/83.07.06.x.html

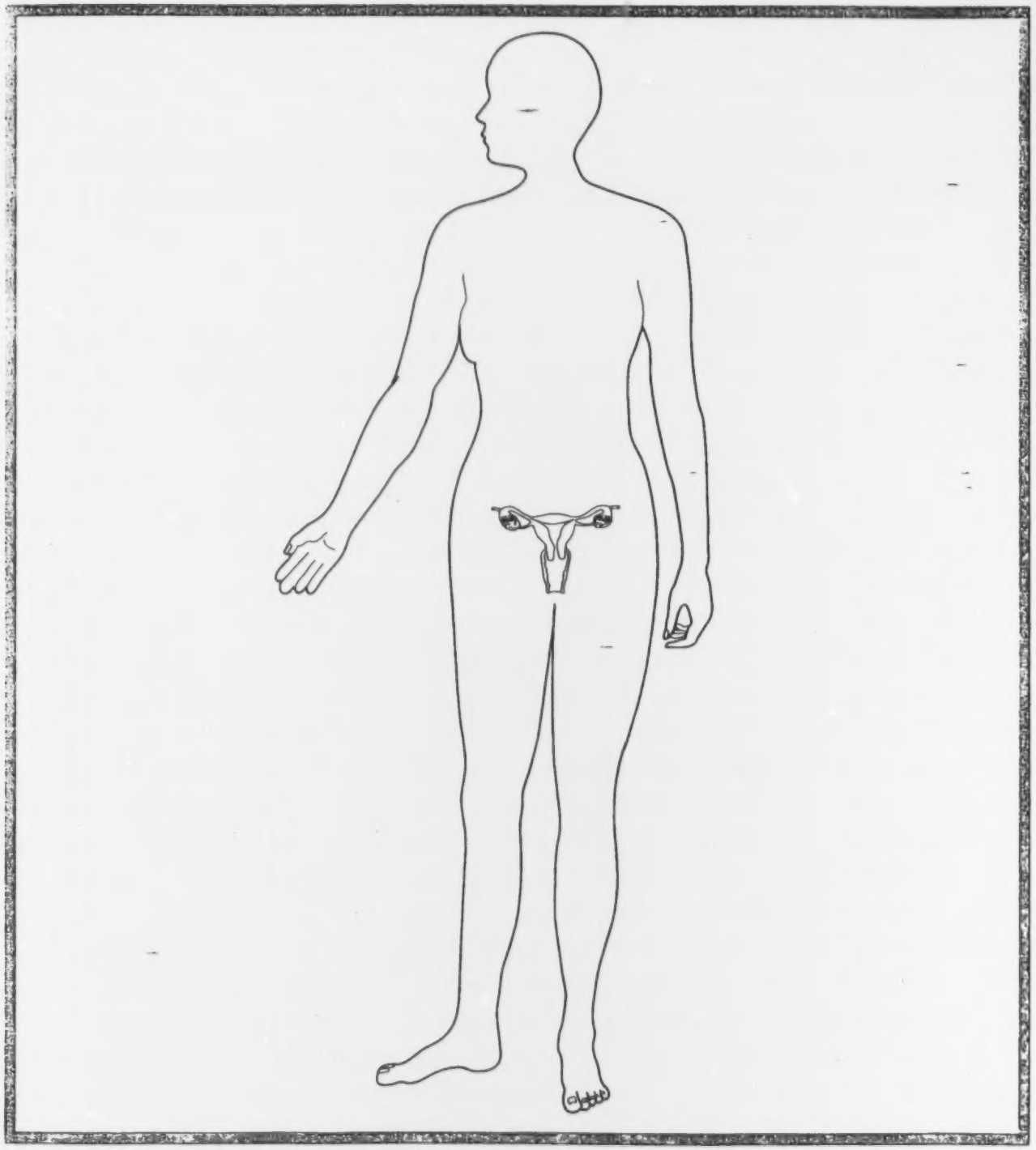
  This site includes ultrasonograms of fetuses.

- http://www.idtonline.org/modules/brit-1/brit-1.htm

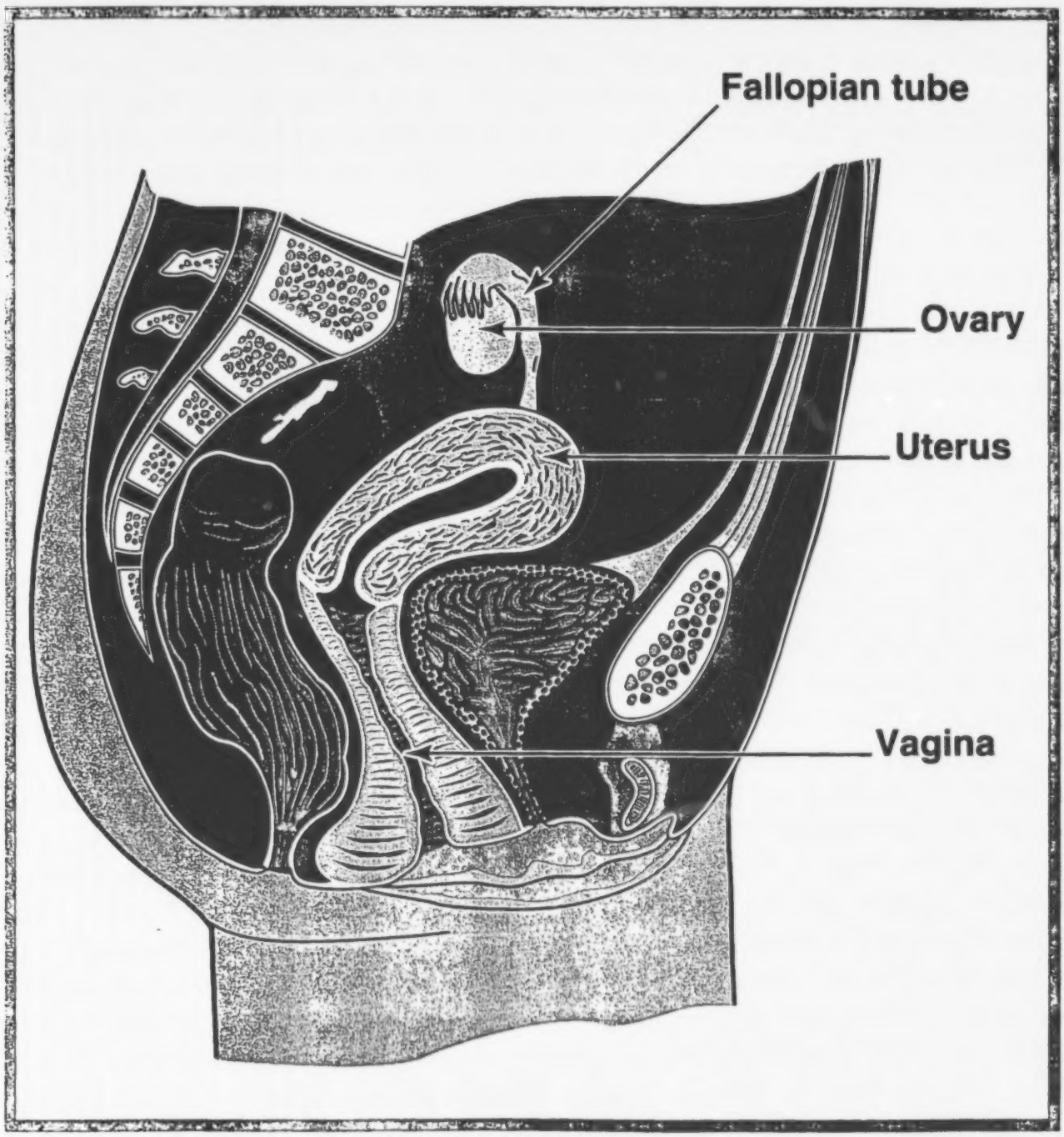
  This site offers a complete lesson on the female reproductive system, including a pretest, instructional materials, and other aids.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

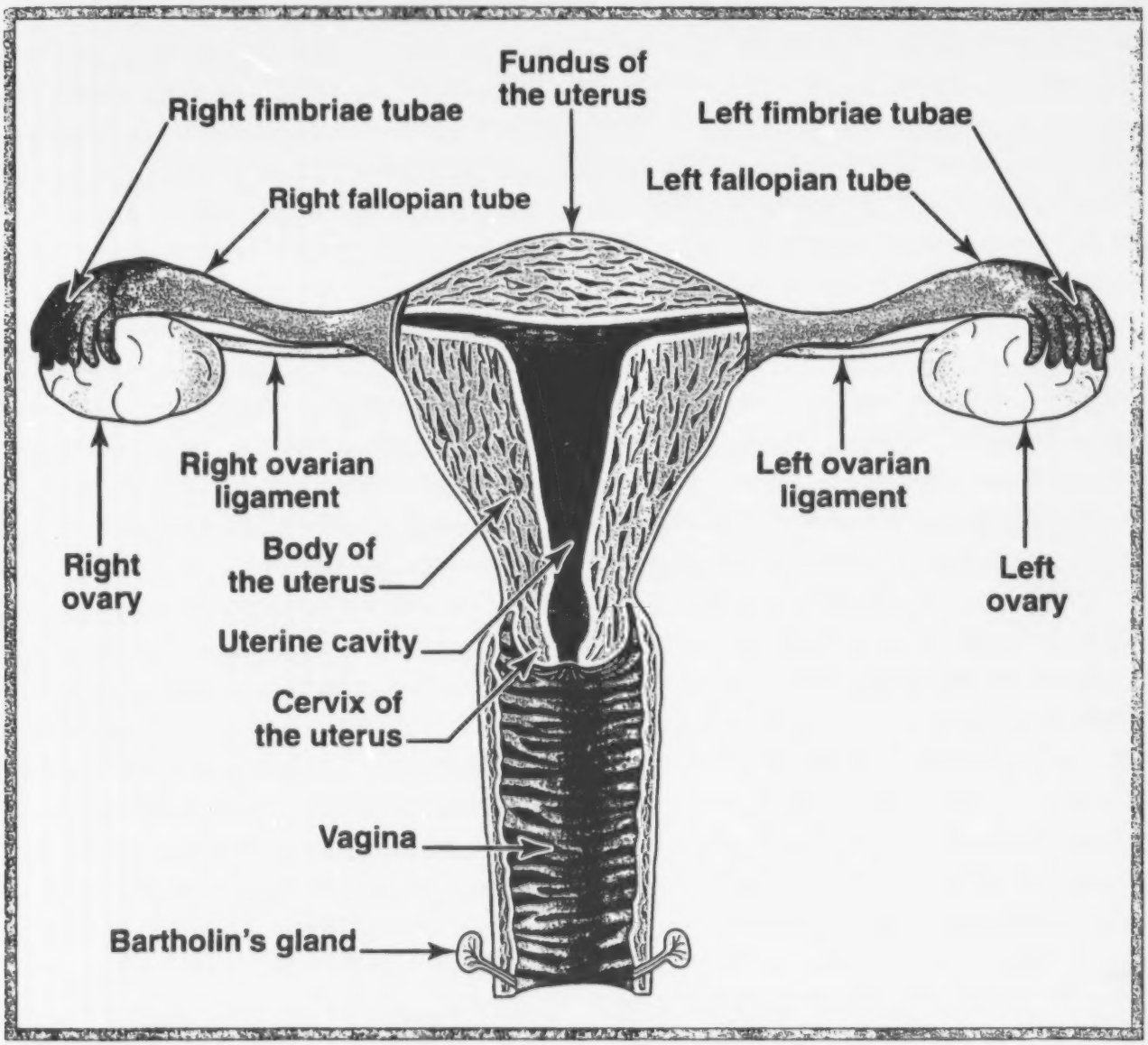
Female Reproductive System



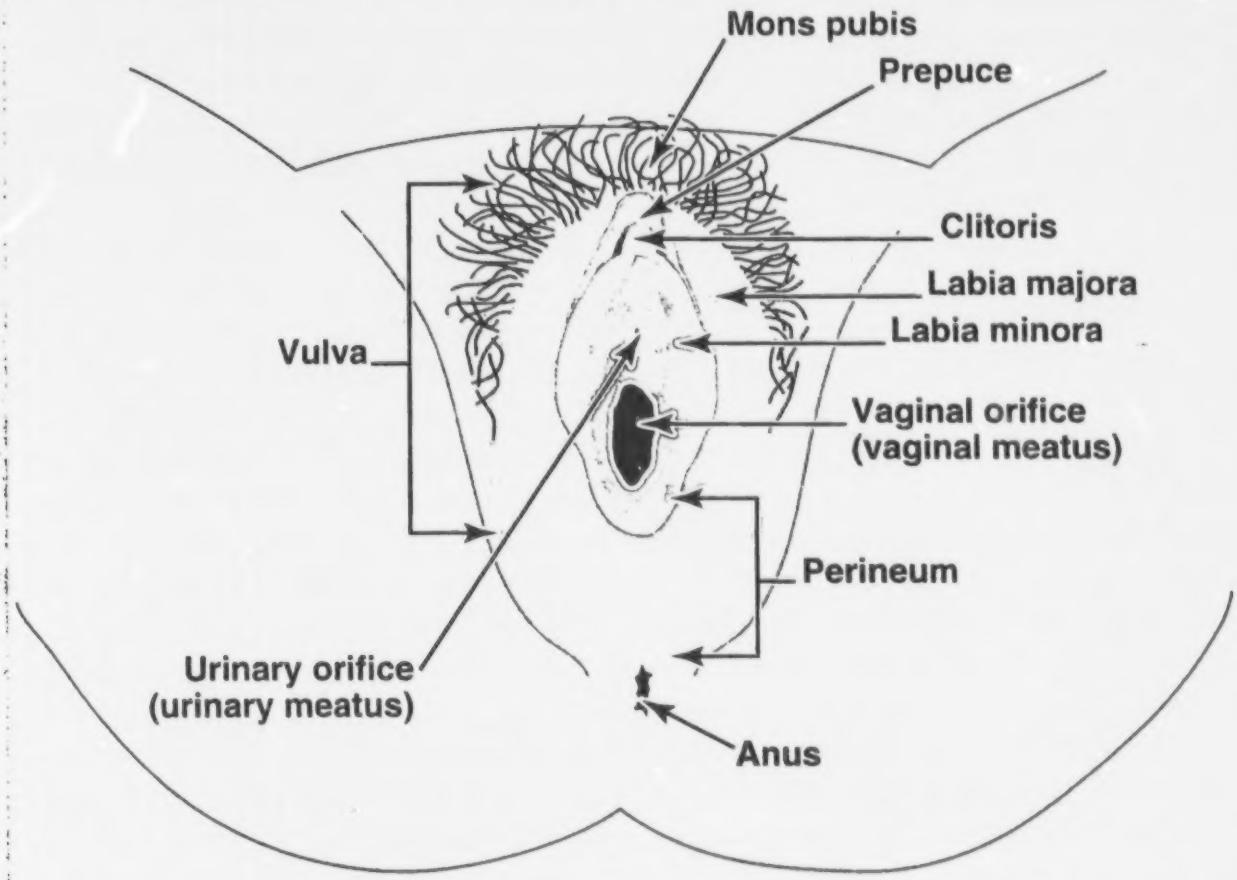
Major Internal Organs and Structures of the Female Reproductive System



Major Structures and Substructures of the Internal Female Reproductive System



Major Structures of the External Female Reproductive System



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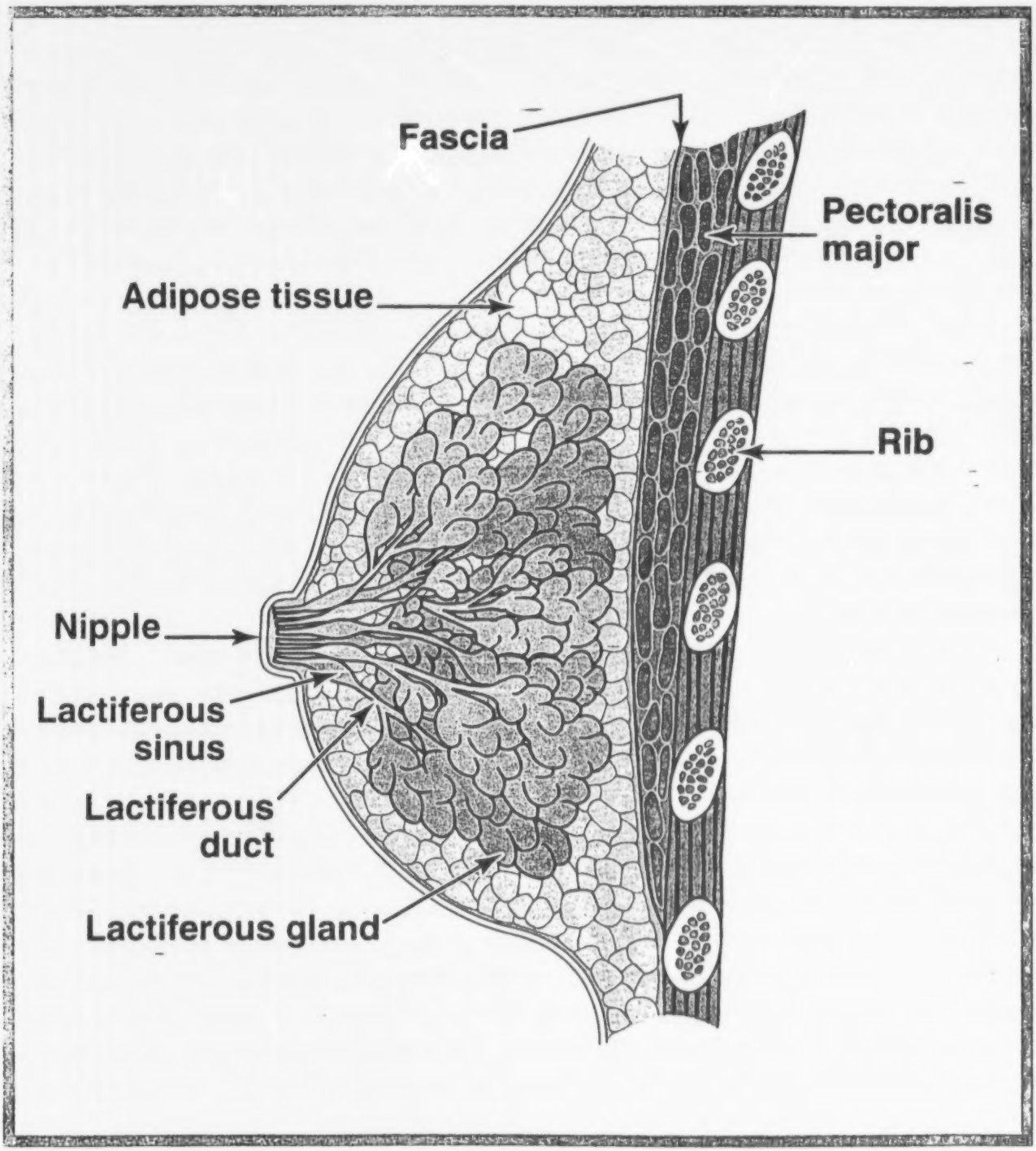
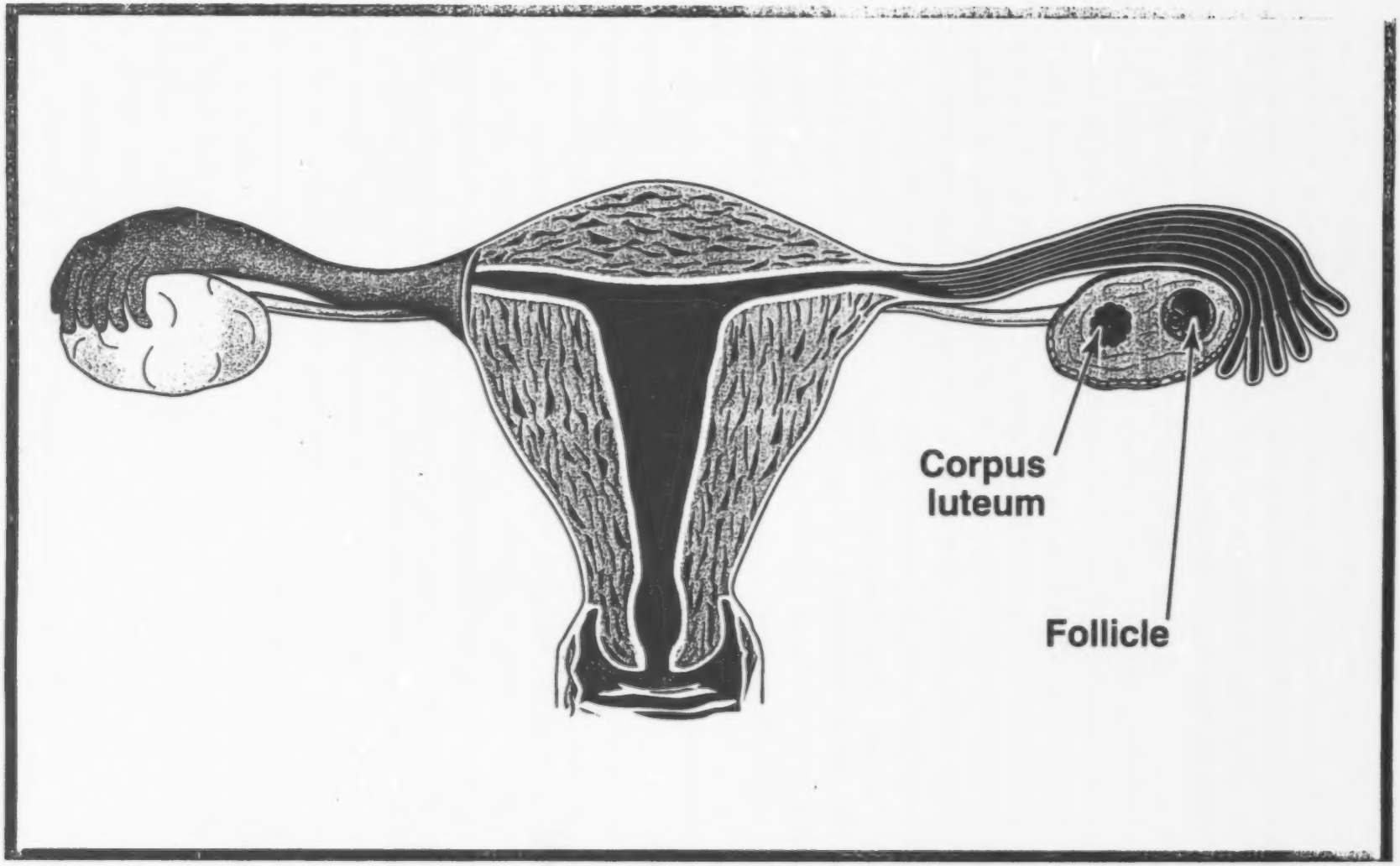
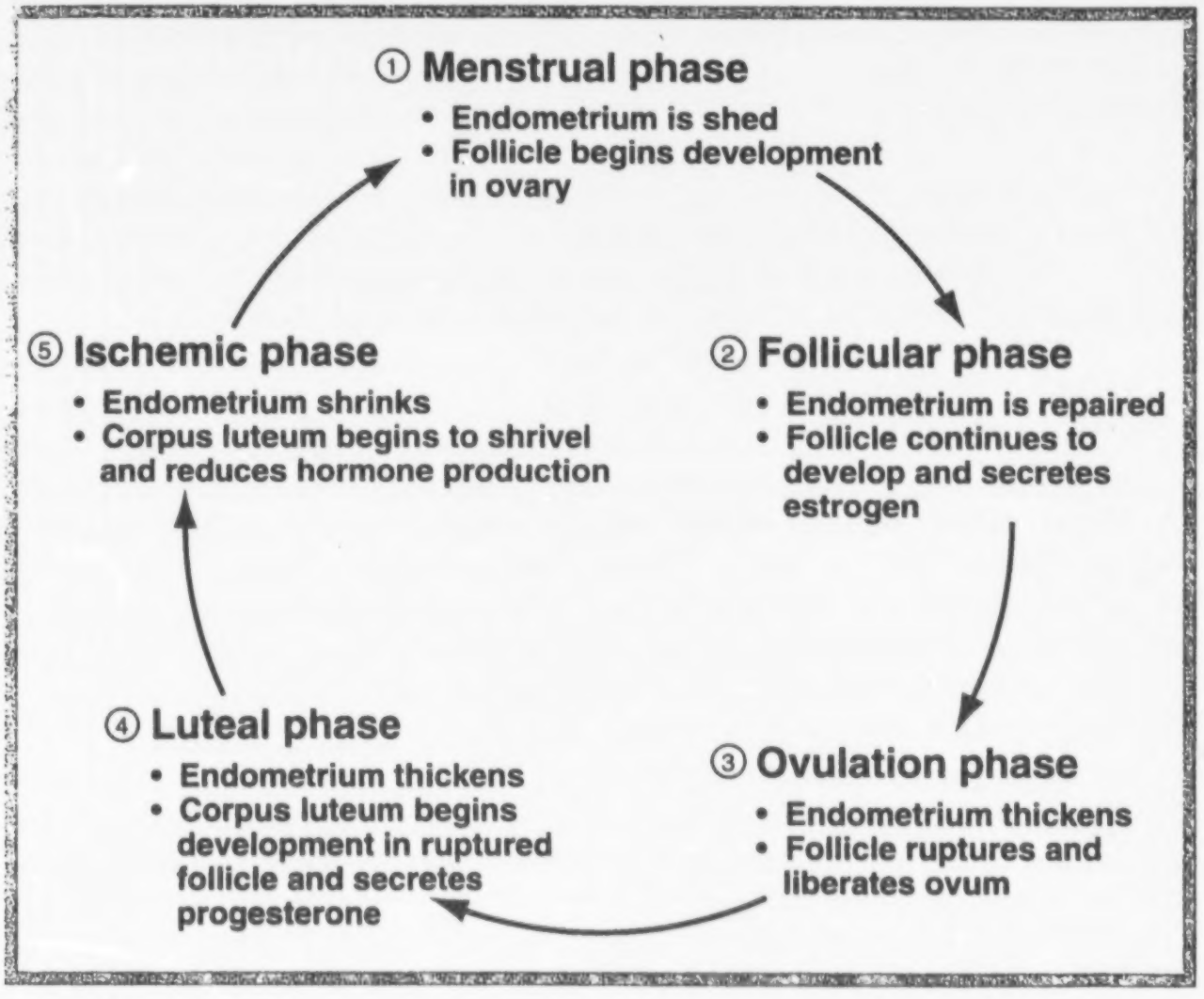
Major Structures of a Breast (Lateral View)



Follicle and Corpus Luteum



Phases of the Menstrual Cycle


① Menstrual phase
• Endometrium is shed
• Follicle begins development in ovary
② Follicular phase
• Endometrium is repaired
• Follicle continues to develop and secretes estrogen
③ Ovulation phase
• Endometrium thickens
• Follicle ruptures and liberates ovum
④ Luteal phase
• Endometrium thickens
• Corpus luteum begins development in ruptured follicle and secretes progesterone
⑤ Ischemic phase
• Endometrium shrinks
• Corpus luteum begins to shrivel and reduces hormone production

Written Test

Name _____

Date _____ Score _____

Objective 1 Define the term *female reproductive system*. Write your answer on the blank lines provided beside the term below.

Female reproductive system _____

_____

Objective 2 Define the term *ovum*. Write your answer on the blank lines provided beside the term below.

Ovum _____

_____

Objective 3 Define the term *fertilization*. Write your answer on the blank lines provided beside the term below.

Fertilization _____

_____

Objective 4 State the functions of the female reproductive system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

d. _____

Objective 5 List the major divisions of the female reproductive system. Write your answers on the blank lines provided below.

a. _____

b. _____

c. _____

Module 15: Reproductive System—Female

Objective 6 Define the major organs and structures of the internal female reproductive system. Write your answers on the blank lines provided beside each of the terms below.

a. Ovary _____

_____

b. Fallopian tube _____

_____

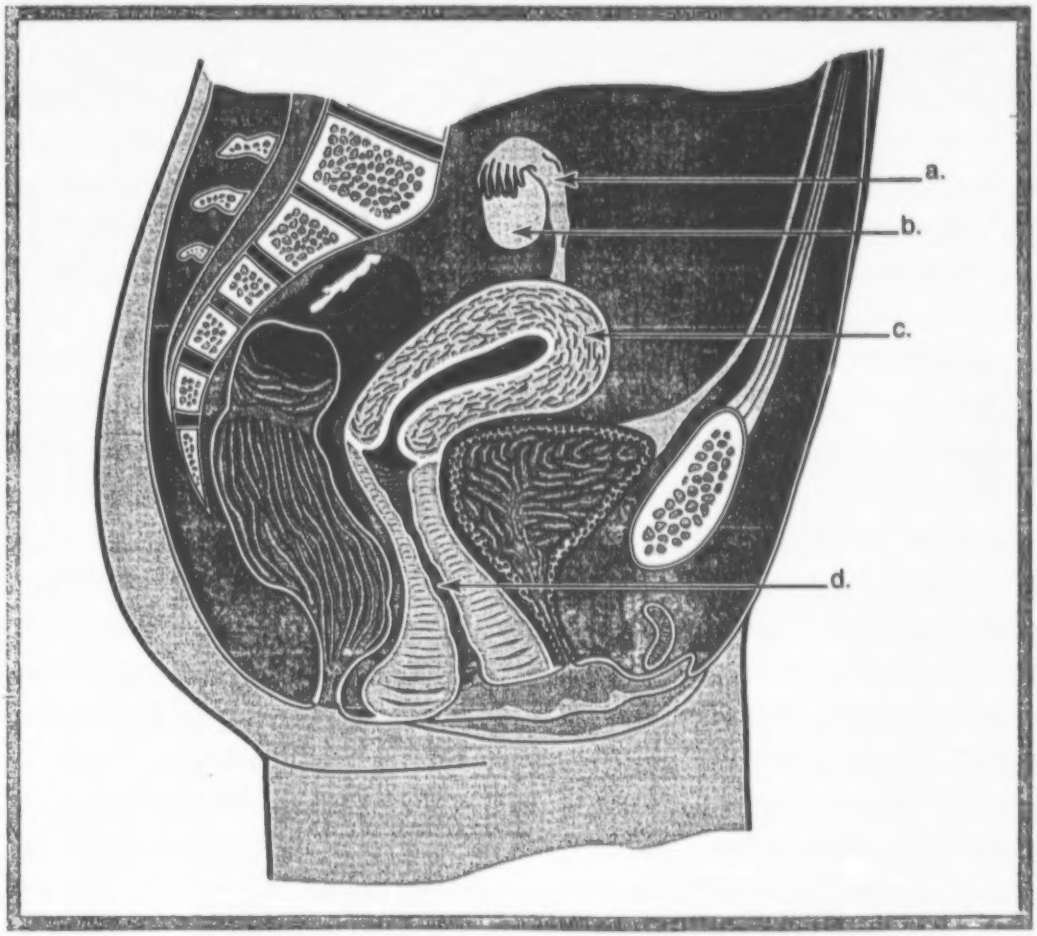
c. Uterus _____

_____

d. Vagina _____

_____

Objective 7 Label the major internal organs and structures of the female reproductive system. Write your answers on the blank lines provided on the next page.



a. _____ c. _____

b. _____ d. _____

Objective 8

Complete statements that describe the characteristics and structure of the ovaries. Write your answers on the blank lines provided in the statements below.

a. Each of the two ovaries resembles an _____ in size and shape.

b. The ovaries are located on either side of the _____ and are attached to the back of the broad ligament behind and below the _____; each ovary lies between the folds of the broad _____.

c. The ovaries are anchored to the uterus by the _____.

d. The major functions of the ovaries are to produce, develop, mature, and discharge _____ and to secrete the female hormones _____ and _____.

e. _____ helps in the development of female secondary sex characteristics and in the growth of the female reproductive organs.

f. _____ contributes to the growth of the endometrium and in the maintenance of pregnancy.

Objective 9

Complete statements that describe the characteristics and structure of the fallopian tubes. Write your answers on the blank lines provided in the statements below and on the next page.

a. Each fallopian tube is approximately _____ inches long and is muscular and lined with _____.

b. Each fallopian tube is attached to the upper, outer angles of the _____ and opens into the _____.

c. At the point of attachment to the _____, each fallopian tube is very narrow but gradually increases in size so that the distal end is larger.

d. The margin of each distal end is funnel-shaped and consists of a number of finger-like projections called the _____, which are connected to an ovary and contain cilia that move an ovum toward the uterus.

e. The fallopian tubes provide an area where the ovum is nourished and delayed for _____.

f. The fallopian tubes provide the place for _____ and act as the passageway for _____.

g. _____ in the fallopian tubes moves the ova toward the uterus to be implanted if it is fertilized and to be shed with the uterine lining if it is not fertilized.

OBJECTIVE 10 Complete statements that describe the characteristics and structure of the uterus. Write your answers on the blank lines provided in the statements below and on the next page.

a. The uterus is a muscular organ located in the pelvic cavity _____ to the rectum and _____ to the urinary bladder.

b. The uterus is not firmly attached to any part of the skeleton but is instead suspended in the pelvic cavity by various _____.

c. The uterus is approximately _____ inches long, about _____ inches wide at the upper end, and about _____ inch thick.

d. The uterus consists of three major sections: the _____, the _____, and the _____.

e. The _____ is the convex, rounded superior portion of the uterus, measuring about 3 inches (75 millimeters) long and 2 inches (50 millimeters) wide at its widest point.

f. The _____ is the lowest, constricted portion of the uterus that extends into the vagina.

g. The body is the middle portion of the uterus between the _____ and the _____.

h. The uterine cavity is triangular in shape with an opening in each angle of the triangle, including the _____ at the top two angles of the triangle and the opening to the _____ below.

i. The uterine cavity is small because of the thickness of the _____ walls.

j. The uterus serves three main functions: to contain and nourish the embryo and the developing fetus from the time the fertilized egg is implanted until the time of delivery, which is the condition of _____; to contract its muscles to expel the fetus at the end of pregnancy, which is the process of _____; and to slough off the endometrium if an egg is not implanted, which is the process of _____.

k. The uterus becomes enormously enlarged during pregnancy, increasing to _____ inches or more in length, and _____ to _____ inches in width.

l. The uterus returns to near its original size after delivery, but it is always slightly _____ than before pregnancy.

m. After _____, the uterus becomes smaller and atrophies.

n. Because the uterus is a suspended structure, it is subject to _____.

o. Normally, the cervix points toward the lower end of the _____ with the fundus inclined forward toward the _____ region, but uterine position is altered by gravity or by change in body position.

p. A full bladder tilts the uterus _____; a distended rectum tilts the uterus _____.

q. _____ is an abnormal forward tilt of the uterus.

r. _____ is an abnormal forward bending of the fundus and the body at the cervix, which may or may not include displacement of the cervix.

s. _____ is an abnormal backward bending of the fundus and the body at the cervix, with the position of the cervix usually unchanged.

OBJECTIVE 11

Complete statements that describe the characteristics and structure of the vagina. Write your answers on the blank lines provided in the statements below.

a. The vagina is a muscular canal lined with mucous membrane and situated in front of the _____ and behind the _____ and _____.

b. The vagina has folds of _____ and is a collapsible tube that is the passageway from the uterus to outside the body.

c. The posterior wall of the vagina is approximately _____ to _____ inches long, and the anterior wall is approximately _____ to _____ inches long.

d. The principal functions of the vagina are to receive the _____ during copulation, to receive the _____ from the male, to serve as the lower part of the _____ by stretching to allow the passage of the fetus, and to act as the _____ for uterine secretions and menstrual flow.

OBJECTIVE 12

Complete statements that describe the major structures of the external female reproductive system. Write your answers on the blank lines provided in the statements below and on the next page.

a. The _____ is the external genitalia of women that comprises the mons pubis, labia majora, labia minora, clitoris, urinary orifice, vaginal orifice, and Bartholin's glands.

b. The _____ is the prominent, skin-covered fat pad over the symphysis pubis that becomes covered with hair after puberty.

c. The _____ are the two outer, fatty longitudinal folds of skin on each side of the vaginal orifice that are covered with pigmented skin and hair on the outer surface but that are free of hair on the inside mucous lining.

d. The _____ are the two longitudinal folds of epithelial tissue located within the labia majora that come together at their anterior in the prepuce of the clitoris.

e. The _____ is the small, erectile organ at the anterior part of the vulva that is similar to the penis in men.

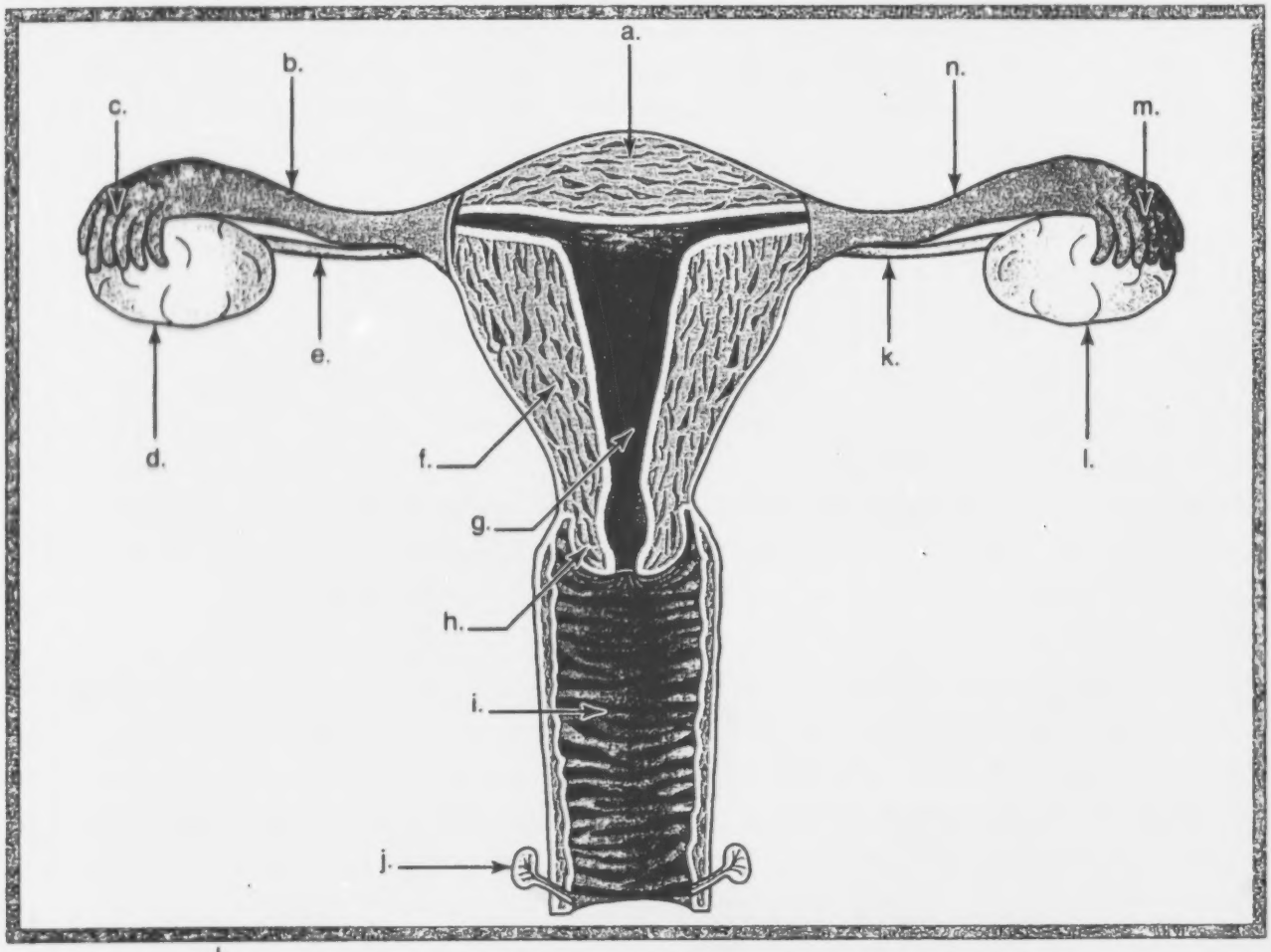
f. The _____—also called the _____—is the external opening of the urethra.

g. The _____—also called the _____—is the external opening of the uterus.

h. _____ are the two bean-shaped glands on either side of the vaginal orifice that secrete lubricating fluid.

i. The _____ is the region between the vaginal orifice and the anus, composing the muscular floor of the pelvis.

OBJECTIVE 13 Label the major structures and substructures of the internal female reproductive system. Write your answers on the blank lines provided below the following illustration.



a. _____ h. _____

b. _____ i. _____

c. _____ j. _____

d. _____ k. _____

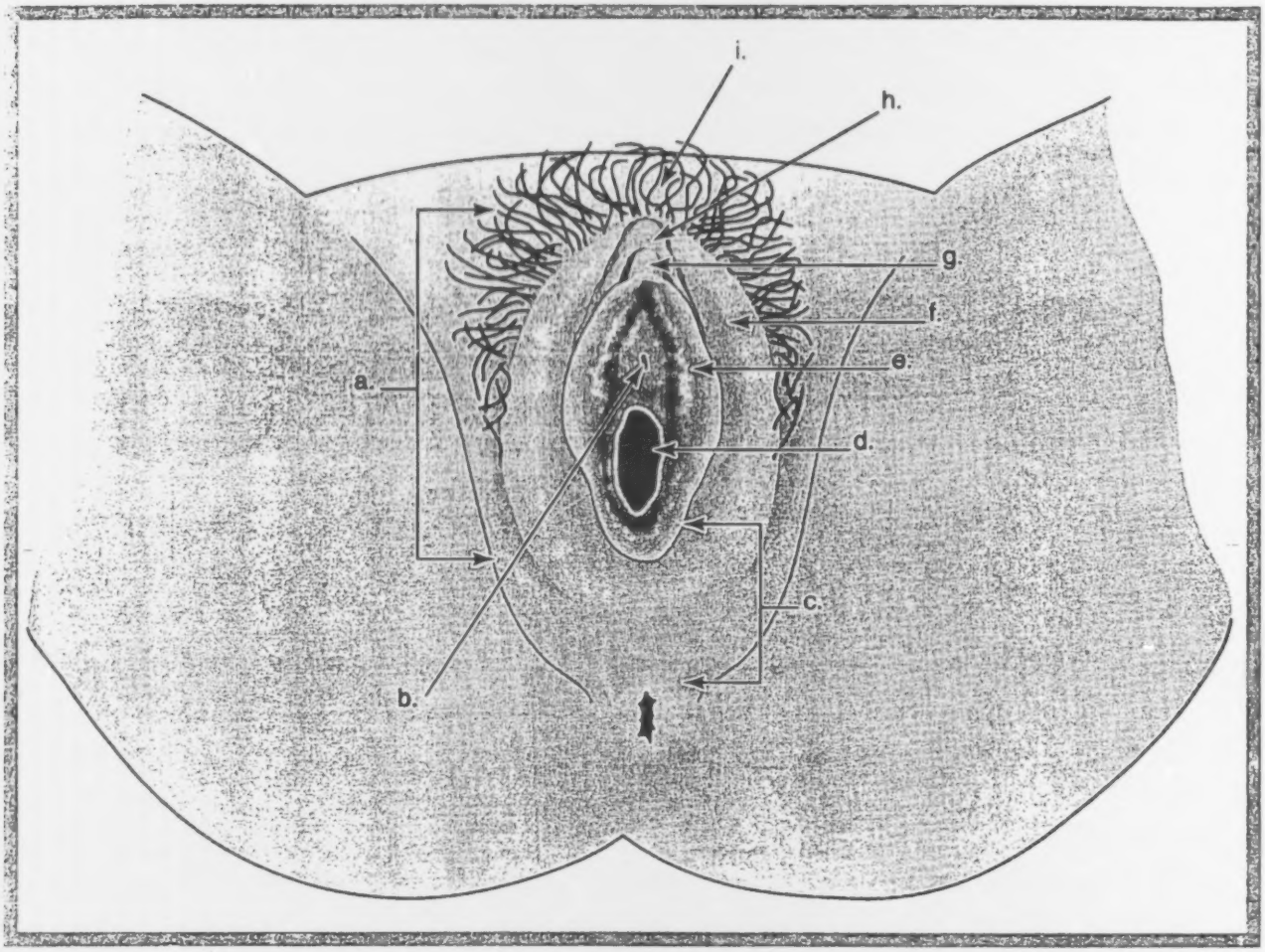
e. _____ l. _____

f. _____ m. _____

g. _____ n. _____

Module 15: Reproductive System—Female

OBJECTIVE 14 | Label the major structures of the external female reproductive system. Write your answers on the blank lines provided below the following illustration.



a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____

Objective 15

Complete statements that describe the characteristics and structure of the breasts. Write your answers on the blank lines provided in the statements below.

a. The breasts lie over the _____ muscle and each is attached to the _____ muscle by a layer of connective _____ tissue.

b. The central portion of each breast is filled with _____ tissue; the outer portion is made up of mostly _____ tissue.

c. The _____ tissue—called the *lactiferous glands*—consists of a series of lobes; each lobe has a system of _____ and _____ for the passage of milk to the nipple.

d. The nipple is the small, round, _____ structure that projects just below the center of each breast.

e. The tip of each nipple has about 20 tiny openings from the _____.

f. The pigmented skin that surrounds a nipple is called the _____.

g. The _____ become functional after delivery of an infant when they are stimulated by the flow of the hormone prolactin.

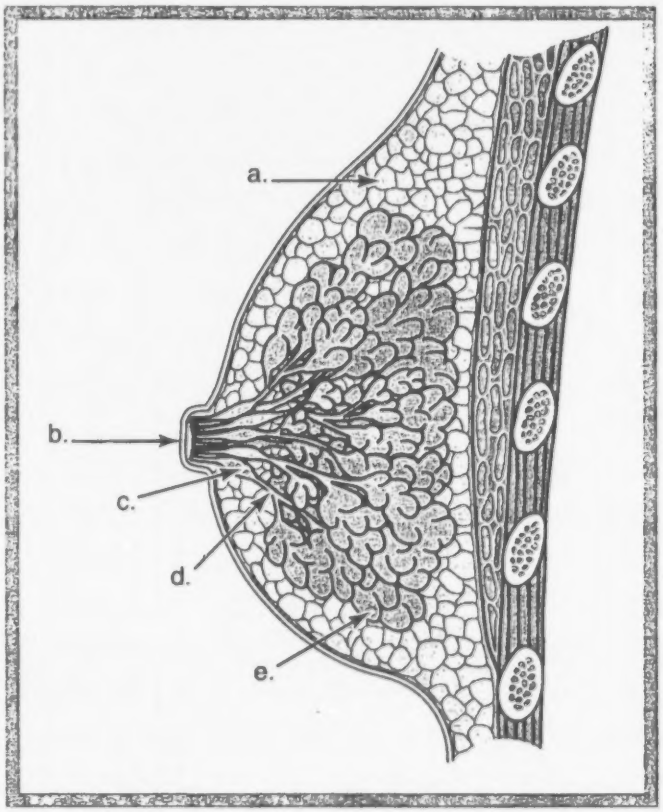
h. Prolactin secretion begins in response to a decrease of _____ in the blood as a result of the expulsion of the _____.

i. It takes three or four days for the _____ level to drop enough so that prolactin stimulates the production of milk in the breasts; during those three or four days, the breasts produce a thin, yellowish secretion called _____.

j. _____ consists of maternal antibodies to boost the infants' immune system, white blood cells, water, protein, fat, minerals, vitamins, and carbohydrates.

OBJECTIVE 16

Label the major structures of a female breast. Write your answers on the blank lines provided below the following illustration.



a. _____ d. _____

b. _____ e. _____

c. _____

OBJECTIVE 17

Describe the stages of development of the female reproductive organs. Write your answers on the blank lines provided below and on the next page.

a. _____

_____

b. _____

_____

c. _____

_____

d. _____

_____

OBJECTIVE 18

Complete statements that describe menstruation and the menstrual cycle. Write your answers on the blank lines provided in the statements below and on the next page.

a. The onset of menstruation—referred to as _____—occurs at _____ and ceases permanently within the onset of _____.

b. Menstrual discharge consists of _____ tissue, blood, and _____ fluid.

c. Menstruation ceases temporarily during _____.

d. Menstruation may or may not cease during _____.

e. Menstruation may be disrupted due to emotional or hormonal disturbances, _____ disorders, _____ disorders, malnutrition, and other factors.

f. The menstrual cycle lasts _____ to _____ days on the average.

g. The onset of the menstrual cycle is caused by the reduction of ovarian _____ when an ovum is not fertilized.

h. A menstrual cycle is a series of five phases that prepares the female body to become _____ and then prepares it to try again if an _____.

i. The first phase—called the _____ *phase*—lasts 4 to 5 days; during this phase, there is a period of uterine bleeding accompanied by shedding of the endometrium and secretion of the follicle-stimulating hormone (FSH), causing a follicle to begin to develop in the ovary.

j. The second phase—called the _____ *phase*—lasts 9 to 10 days; during this phase, the endometrium is repaired and thickens and the follicle continues to develop and secretes estrogen.

k. The third phase—called the _____ *phase*—usually occurs on the 14th day of the cycle; during this phase, the endometrium continues to thicken and the follicle ruptures and liberates an ovum that moves on to the fallopian tubes.

l. The fourth phase—called the _____ *phase*—lasts 10 to 12 days; during this phase, the endometrium continues to thicken and prepare for the receipt of the ovum if it is fertilized; the corpus luteum—a gland that buds from the ruptured follicle—begins to develop and secrete progesterone.

m. The purpose of progesterone is to spur the growth of blood vessels in the _____ so the uterus will be ready to support a fertilized egg. If a fertilized egg implants, the menstrual cycle is broken and pregnancy begins. Otherwise, the cycle continues.

n. The fifth phase—called the _____ *phase*—lasts 1 to 2 days; during this phase, the arteries constrict and the endometrium becomes anemic and shrinks; also, the corpus luteum begins to shrivel to form a structure called the _____—a scar on the surface of the ovary—and the production of progesterone is reduced.

OBJECTIVE 19 Define terms associated with irregularities of the menstrual cycle. Write your answers on the blank lines provided beside each of the terms below.

a. Amenorrhea _____

_____

b. Oligomenorrhea _____

_____

c. Dysmenorrhea _____

_____

d. Menorrhagia _____

_____

e. Metrorrhagia _____

_____

OBJECTIVE 20

Define the term *surgical menopause*. Write your answer on the blank lines provided beside the term below.

Surgical menopause _____

_____

_____

_____

OBJECTIVE 21

Complete statements that describe the characteristics of pregnancy. Write your answers on the blank lines provided in the statements below.

a. Pregnancy—also called _____—begins with fertilization; as soon as the sperm enters the ovum, cellular changes take place and the embryo begins to form.

b. During pregnancy, the mother's _____ changes shape and size, the _____ elongates, and the umbilical cord forms and extends from the placenta to the embryo.

c. Two umbilical _____ run through the umbilical cord to carry blood from the fetus to the capillaries of the fetal placenta, while the umbilical _____ returns blood to the fetus.

d. The fetus is surrounded by a thin membrane forming a sac—called the _____—and containing a serous fluid—called the _____—in which the fetus is immersed.

e. The mother's body performs the function of eliminating waste and acquiring food for the fetus by osmosis through the _____.

f. The average pregnancy lasts approximately _____ days and is followed by childbirth, which is also called _____.

g. The fetus is delivered when the _____ of the uterus dilates and flattens enough to allow the fetus to be pushed into the _____ by the muscles of the fundus and body of the uterus and the muscles of the vagina.

OBJECTIVE 22

Complete statements that describe the characteristics of fetal development. Write your answers on the blank lines provided in the statements below and on the next page.

a. During _____, an egg is released from the ovary and begins moving down the fallopian tube toward the uterus.

b. As a _____ makes its way through the fluid of the uterus and fallopian tube, it capacitates, which results in the head, or _____, of the sperm fracturing so that its enzymes are secreted.

c. The _____ eat through the outer wall of the ovum when the sperm contacts it, allowing the sperm to enter the ovum.

d. The entry of the sperm _____ into the ovum causes the membrane of the ovum to change, preventing the entry of other sperm.

e. The ovum has _____ pairs of chromosomes: _____ pair of X chromosomes that contribute to sexual characteristics and _____ that determine other inherited traits.

f. The sperm has _____ pairs of chromosomes: _____ that determine the majority of inherited characteristics and a pair of X or Y chromosomes so that fertilization of the ovum by an X-bearing sperm will result in a female fetus while fertilization by a Y-bearing sperm will result in a male fetus.

g. The nuclei of the sperm and ovum fuse and the cell begins dividing, forming a _____ stage within 36 hours and a _____ stage within 48 hours.

h. After about 3 days, the fertilized ovum has become a solid mass of _____ cells called the *morula* and is nearing the opening of the fallopian tube into the uterus.

i. At this point, a _____ develops within the mass of cells forming the blastocyst stage of development.

j. As the blastocyst enters the uterus _____ to _____ days after fertilization, it secretes enzymes that eat into the endometrium, allowing the blastocyst to implant in a cavity in the wall of the uterus.

k. The implanted blastocyst then undergoes embryonic development over the next _____ weeks, creating the embryonic disc.

l. The _____ forms around the embryo and becomes filled with _____ fluid.

m. Embryonic growth continues, during which time all of the _____ will be established and the structural buds of the body will form.

n. Weeks 9 through 40 define the _____ stage, during which development continues and the fetus is nourished by the mother's systems through the umbilical cord and placenta.

OBJECTIVE 23

Describe the stages of labor and delivery. Write your answers on the blank lines provided beside each of the stages below.

a. Stage one _____

_____

_____

_____

b. Stage two _____

_____

_____

_____

c. Stage three _____

_____

_____

_____

Objective 24

Define terms that describe types of abnormal deliveries. Write your answers on the blank lines provided beside each of the terms below.

a. Premature birth _____

b. Breech birth _____

c. Cesarean section _____

d. Still birth _____

e. Multiple births _____

Objective 25

Complete statements that describe the characteristics of genetics and heredity. Write your answers on the blank lines provided in the statements below and on the next page.

a. Each of the cells of the human body—except for ova, sperm, and mature red blood cells—contain _____ chromosomes that have spawned from the original _____ chromosomes that were united through the fertilization of the ovum.

b. The _____ chromosomes exist in pairs that include _____ autosomes and _____ pair of sex chromosomes.

c. One chromosome in each pair originated in the ovum and is referred to as a _____, while the second chromosome of the pair originated in the sperm and is called a _____.

d. Chromosomes consist of _____ and _____.

e. DNA consists of four base compounds found in complementary pairs of _____ with thymine and _____ with cytosine.

f. These four compounds create _____; the segment of DNA for a protein is called a *gene*.

g. The arrangement of these base compounds within a gene creates a code that determines the _____ of an individual.

h. Each possibility for how a gene can affect an individual is called an *allele*, and there are at least _____ alleles for each gene.

i. When the alleles are the same, a _____ condition exists; a _____ condition exists if the alleles are different; this similarity or difference in alleles is referred to as the _____.

j. Normally one allele is _____ and the other is _____; the way the alleles are expressed or exhibited in an individual is called the _____.

k. In some cases, the genetic code may not be properly duplicated in an individual, resulting in a _____.

OBJECTIVE 26 Define common disorders and abnormalities of the female reproductive system. Write your answers on the blank lines provided beside each of the terms below and on the following pages.

a. Sterility _____

_____

b. Premenstrual syndrome (PMS) _____

_____

c. Pelvic inflammatory disease (PID) _____

_____

d. Salpingitis _____

_____

e. Oophritis _____

_____

f. Vaginitis _____

_____

g. Leukorrhea _____

_____

h. Myoma _____

_____

i. Ovarian cyst _____

_____

j. Endometriosis _____

_____

k. Breast cancer _____

_____

l. Uterine cancer _____

_____

m. Cervical cancer _____

_____

n. Ovarian cancer _____

_____

o. Prolapsed uterus _____

_____

p. Ectopic pregnancy _____

_____

q. Placenta previa _____

_____

r. Abruptio placentae _____

_____

s. Preeclampsia _____

_____

t. Eclampsia _____

_____

u. Spontaneous abortion _____

_____

v. Puerperal fever _____

_____

w. Mastitis _____

_____

Answers to Written Test

Objective 1

The female gonads, the associated ducts and organs, and the external genitalia that function in the procreation of offspring

Objective 2

An egg; a mature female germ cell

Objective 3

The union of the male gamete (spermatozoon) and female gamete (ovum) to form a zygote from which an embryo develops

Objective 4

Anwers may appear in any order.

a. Perpetuation of the human species
b. Development of the fetus
c. Sexual gratification
d. Secretion of hormones

Objective 5

Anwers may appear in any order.

a. Internal
b. External
c. Breasts

Objective 6

a. One of a pair of internal female reproductive organs that are found on each side of the lower abdomen on either side of the uterus and that produce ova and female sex hormones

b. Either of a pair of internal tubes that conduct an ovum from an ovary to the uterus

c. The womb; the hollow, pear-shaped internal female organ of reproduction in which the fertilized ovum is implanted and the fetus develops

d. The canal in a female that leads from the uterus to the external vaginal orifice of the genital canal

Objective 7

a. Fallopian tube
b. Ovary
c. Uterus
d. Vagina

Objective 8

a. almond
b. uterus; fallopian tubes; ligament
c. ovarian ligament
d. ova; estrogen; progesterone
e. Estrogen
f. Progesterone

Objective 9

a. 4; mucosa
b. uterus; uterus
c. uterus
d. fimbriae tubae
e. fertilization
f. fertilization; spermatoza
g. Peristaltic motion

Objective 10

a. anterior; posterior
b. ligaments
c. 3; 2; 1
d. fundus; body; cervix
e. fundus
f. cervix
g. fundus; cervix
h. fallopian tubes; cervix
i. muscular
j. pregnancy; labor; menstruation
k. 12; 8; 10
l. larger
m. menopause
n. displacement
o. sacrum; suprapubic
p. backward; forward
q. Anteversion
r. Anteflexion
s. Retroversion

Objective 11

a. rectum; urethra; urinary bladder
b. rugae
c. 3; 4; 2½; 3
d. penis; seminal fluid; birth canal; excretory duct

Objective 12

a. vulva
b. mons pubis
c. labia majora
d. labia minora
e. clitoris
f. urinary orifice; urinary meatus
g. vaginal orifice; vaginal meatus
h. Bartholin's glands
i. perineum

Objective 13

a. Fundus of the uterus
b. Right fallopian tube
c. Right fimbriae tubae
d. Right ovary
e. Right ovarian ligament
f. Body of the uterus
g. Uterine cavity
h. Cervix of the uterus
i. Vagina
j. Bartholin's gland
k. Left ovarian ligament
l. Left ovary
m. Left fimbriae tubae
n. Left fallopian tube

Objective 14

a. Vulva
b. Urinary orifice (urinary meatus)
c. Perineum
d. Vaginal orifice (vaginal meatus)
e. Labia minora
f. Labia majora
g. Clitoris
h. Prepuce
i. Mons pubis

Objective 15

a. pectoralis; pectoralis; fascia
b. glandular; adipose
c. glandular; ducts; sinuses
d. pigmented
e. lactiferous ducts
f. areola
g. lactiferous glands
h. estrogen; placenta
i. estrogen; colostrum
j. Colostrum

Objective 16

a. Adipose tissue
b. Nipple
c. Lactiferous sinus
d. Lactiferous duct
e. Lactiferous gland

Objective 17

a. For approximately the first two months of embryonic life, no sexual differentiation is evident, though by the end of the third month, the sex of the fetus is clearly distinguishable.

b. At birth, the ovaries contain thousands of immature germ cells called *oocytes*.

c. Puberty is indicated in the female by the onset of ovulation and menstruation and the appearance of secondary sexual characteristics.

d. The ovaries usually become inactive at about 45 years of age; the cessation of ovulation and menstruation is referred to as *menopause*.

Objective 18

a. menarche; puberty; menopause
b. endometrial; serous
c. pregnancy
d. lactation
e. physical; congenital
f. 27; 28
g. hormones
h. pregnant; ovum is not fertilized
i. menstrual
j. follicular
k. ovulation
l. luteal
m. endometrium
n. ischemic; corpus albicans

Objective 19

a. The absence of menstruation
b. Abnormally light or infrequent menstruation
c. Pain associated with menstruation
d. Abnormally heavy or long menstrual periods
e. Uterine bleeding other than that caused by menstruation

Objective 20

The removal of an organ, such as the ovaries or uterus, so as to interrupt the hormones or physiological structures that regulate menstruation

Objective 21

a. gestation
b. uterus; vagina
c. arteries; vein
d. amnion; amniotic fluid
e. placental membranes
f. 280; parturition
g. cervix; vaginal canal

Objective 22

a. ovulation
b. spermatozoon; acrosome
c. enzymes
d. nucleus
e. 23; one; 22
f. 23; 22
g. two-cell; four-cell
h. 16
i. hollow space
j. seven; eight
k. eight
l. amnion; amniotic
m. organ systems
n. fetal

Objective 23

a. The secretion of progesterone decreases and the secretion of estrogen increases, causing weak, irregular contractions that force the amnion into the cervix; this dilates the cervix and eventually ruptures the amnion

b. The secretion of oxytocin by the posterior pituitary gland produces powerful contractions in the uterus that push the fetus from the uterus and out the birth canal

c. Continued uterine contractions expel the placenta from the uterus and out the birth canal

Objective 24

a. Delivery of the infant after less than 40 weeks of pregnancy
b. Presentation of the infant at birth in any position other than head downward
c. Delivery of an infant by surgically opening the abdomen and uterus
d. Delivery of a lifeless infant
e. Delivery of more than one infant from a pregnancy

Objective 25

a. 46; 46
b. 46; 22; one
c. maternal chromosome; paternal chromosome
d. deoxyribonucleic acid; protein
e. adenine; guanine
f. proteins
g. inherited characteristics
h. two
i. homozygous; heterozygous; genotype
j. dominant; recessive; phenotype
k. mutation

OBJECTIVE 26

a. The inability to reproduce

b. A collection of conditions, including irritability, depression, fatigue, weight gain, edema, headache, and nervousness, that may accompany the premenstrual cycle in some women

c. Any inflammation of the female pelvic organs, especially one caused by bacterial infection

d. An inflammation or infection of the uterine tubes

e. An inflammation of one or both ovaries

f. An inflammation of the vagina

g. A whitish discharge that accompanies some vaginal infections

h. A common, benign tumor of the uterine muscle

i. A benign enlargement of the ovary often caused by a follicle that fails to rupture or a corpus luteum that fails to disintegrate

j. The presence of functioning endometrial tissue outside the uterus

k. Cancer of the breast

l. Cancer of the uterus

m. Cancer of the cervix

n. Cancer of the ovaries

o. A condition in which weakened uterine ligaments allow retroflexion of the uterus, which may then sink into the vagina

p. An abnormal pregnancy in which the embryo implants outside the uterine cavity

q. A condition of pregnancy in which the placenta is implanted abnormally in the uterus so that it impinges on or covers the cervical opening

r. Separation of the placenta from the uterine wall after 20 weeks of pregnancy

s. A toxic condition of pregnancy characterized by hypertension, proteinuria, edema, hemorrhaging, and even stroke after the 24th week of pregnancy

t. The gravest form of pregnancy-induced hypertension, characterized by convulsion, coma, hypertension, proteinuria, and edema

u. The loss of an embryo or fetus before the 20th week of pregnancy

v. A bacterial infection of postpartum mothers that can progress to septicemia

w. An inflammation of the breast, usually caused by streptococcal or staphylococcal infection

Answers to Assignment Sheet

Assignment Sheet 1

Part A

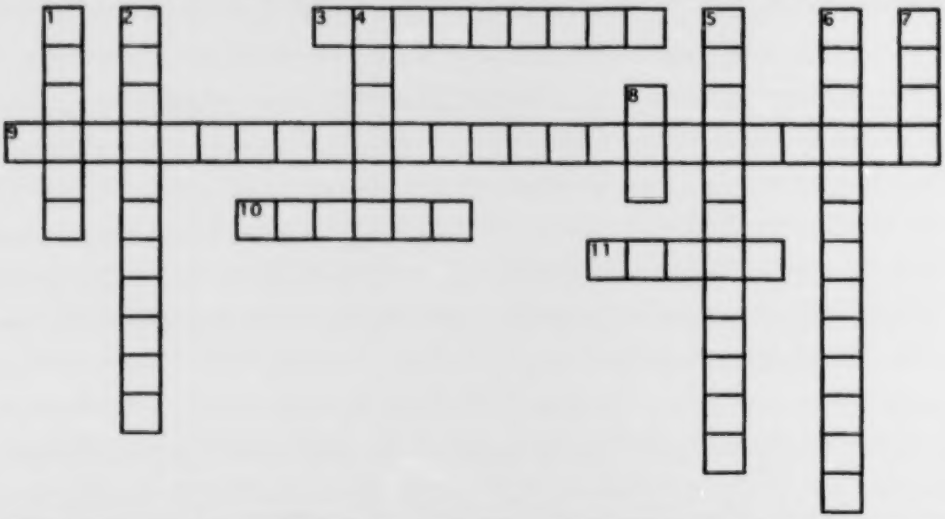
CASE STUDY 1	5
CASE STUDY 2	5
CASE STUDY 3	10, 2
CASE STUDY 4	6, 7
CASE STUDY 5	6

Part B

INVESTIGATIVE REPORT	Answers will depend on the facility assigned; therefore, the report must be evaluated to the satisfaction of the instructor.

Crossword Puzzle 1—Terms from Objectives 1 Through 4

Name _____ Date _____



ACROSS

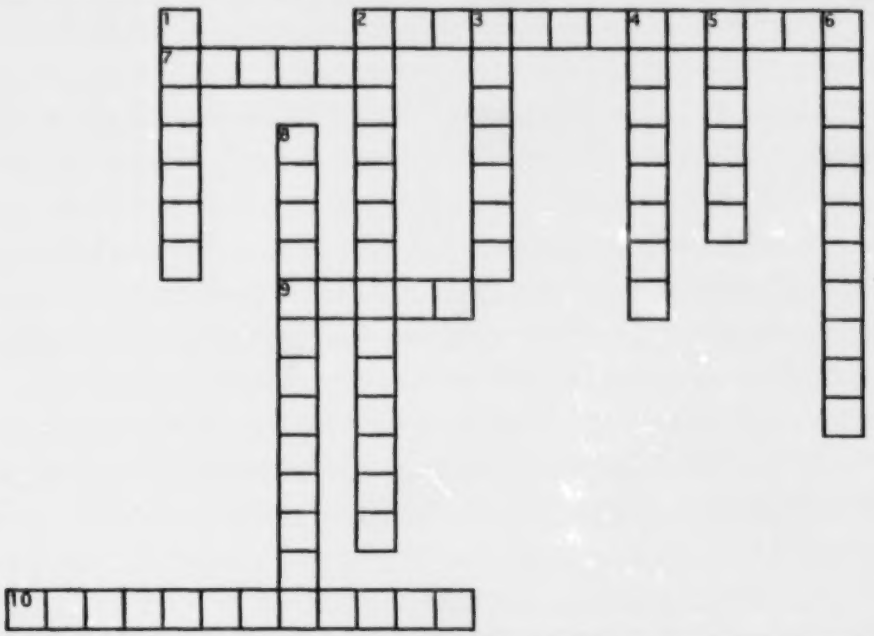
3. The organs of the reproductive system and the associated structures of either sex
9. The female gonads, the associated ducts and organs, and the external genitalia that function in the procreation of offspring (3 words)
10. The cell formed by the union of two gametes; a developing ovum from the time it is fertilized until it is implanted in the uterus
11. The unborn offspring of a human after it has attained the particular form of the species; the developing human being after the embryonic period and until its birth

DOWN

1. A mature male or female germ cell; the ovum in a female
2. An ovary; the reproductive gland in a female that produces gametes (2 words)
4. The unborn offspring of a human being between the time of implantation of the fertilized ovum about 2 weeks after fertilization until the end of the seventh or eighth week, when it becomes a fetus
5. The discharging of blood, secretions, and tissue debris from the uterus that recurs in nonpregnant, mature females at approximately monthly intervals
6. The union of the male gamete (spermatozoon) and female gamete (ovum) to form a zygote from which an embryo develops
7. An egg; a mature female germ cell
8. The plural of ovum

Crossword Puzzle 2—Terms from Objectives 5 Through 9

Name _____ Date _____



ACROSS

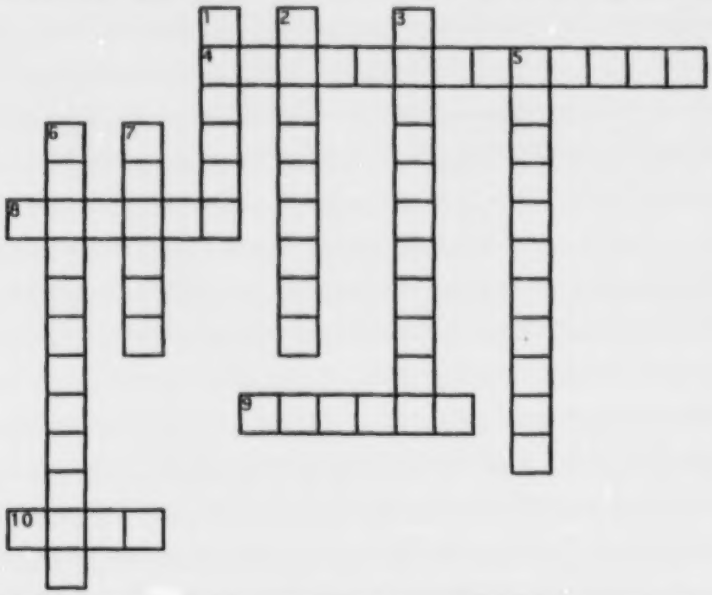
2. Finger-like projections that are connected to an ovary and contain cilia that move an ovum toward the uterus (2 words)
7. The canal in a female that leads from the uterus to the external vaginal orifice of the genital canal
9. One of a pair of internal female reproductive organs that are found on each side of the lower abdomen on either side of the uterus and that produce ova and female sex hormones
10. The female hormone that contributes to the growth of the endometrium and in the maintenance of pregnancy

DOWN

1. The female reproductive organs that produce, develop, mature, and discharge ova; secrete the female hormones estrogen and progesterone
2. Structures that provide an area where the ovum is nourished and delayed for fertilization; provide the place for fertilization and act as the passageway for spermatozoa (2 words)
3. The two glands on the chest of a mature female that are capable of secreting milk; also called the *mammary glands*
4. The female hormone that helps in the development of female secondary sex characteristics and in the growth of the female reproductive organs
5. The womb; the hollow, pear-shaped internal female organ of reproduction in which the fertilized ovum is implanted and the fetus develops
6. The mucous membrane that lines the uterus and sloughs off during menstruation and following the birth of a child
8. Either of a pair of internal tubes that conduct an ovum from an ovary to the uterus; also called the *uterine tubes*, *salpinges*, or *oviducts* (2 words)

Crossword Puzzle 3—Terms from Objectives 10 and 11

Name _____ Date _____



ACROSS

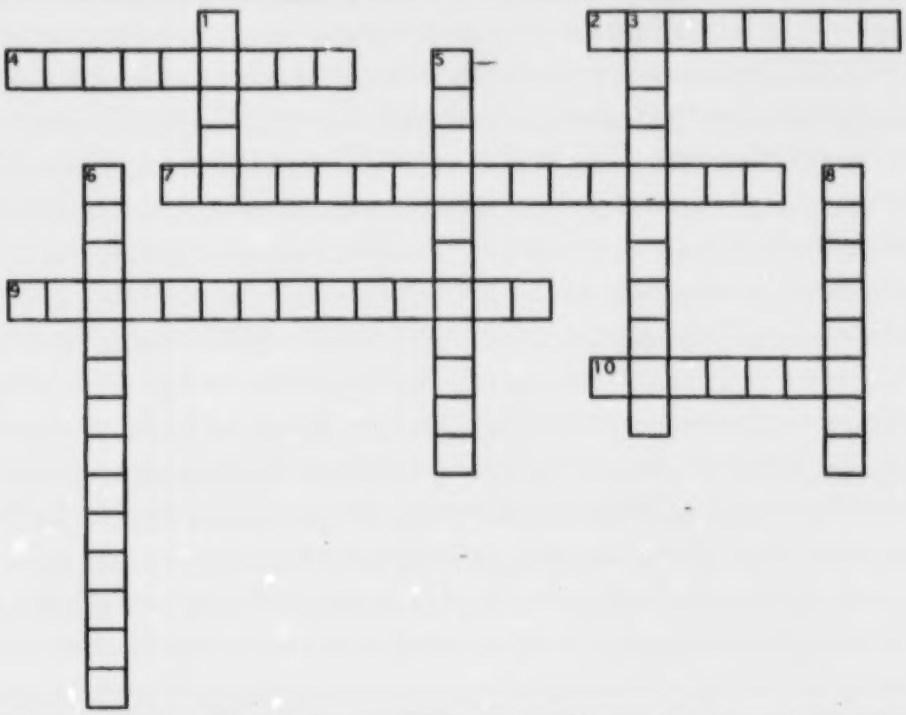
4. The _____ is triangular in shape with an opening in each angle of the triangle, including the fallopian tubes at the top two angles of the triangle and the opening to the cervix below (2 words)
8. A muscular organ located in the pelvic cavity anterior to the rectum and posterior to the urinary bladder; consists of three major sections: the fundus, the body, and the cervix
9. A muscular canal lined with mucous membrane and situated in front of the rectum and behind the urethra and urinary bladder; has folds of rugae and is a collapsible tube that is the passageway from the uterus to outside the body; receives the penis during copulation; receives the seminal fluid from the male; serves as the lower part of the birth canal by stretching to allow the passage of the fetus; acts as the excretory duct for uterine secretions and menstrual flow
10. The middle portion of the uterus between the fundus and the cervix

DOWN

1. The convex, rounded superior portion of the uterus, measuring about 3 inches long and 2 inches wide at its widest point
2. The cessation of menstruation usually occurring between the ages of 45 and 50
3. An abnormal forward tilt of the uterus
5. An abnormal forward bending of the fundus and the body at the cervix, which may or may not include displacement of the cervix
6. An abnormal backward bending of the fundus and the body at the cervix, with the position of the cervix usually unchanged
7. The lowest, constricted portion of the uterus that extends into the vagina

Crossword Puzzle 4—Terms from Objective 12

Name _____ Date _____



ACROSS

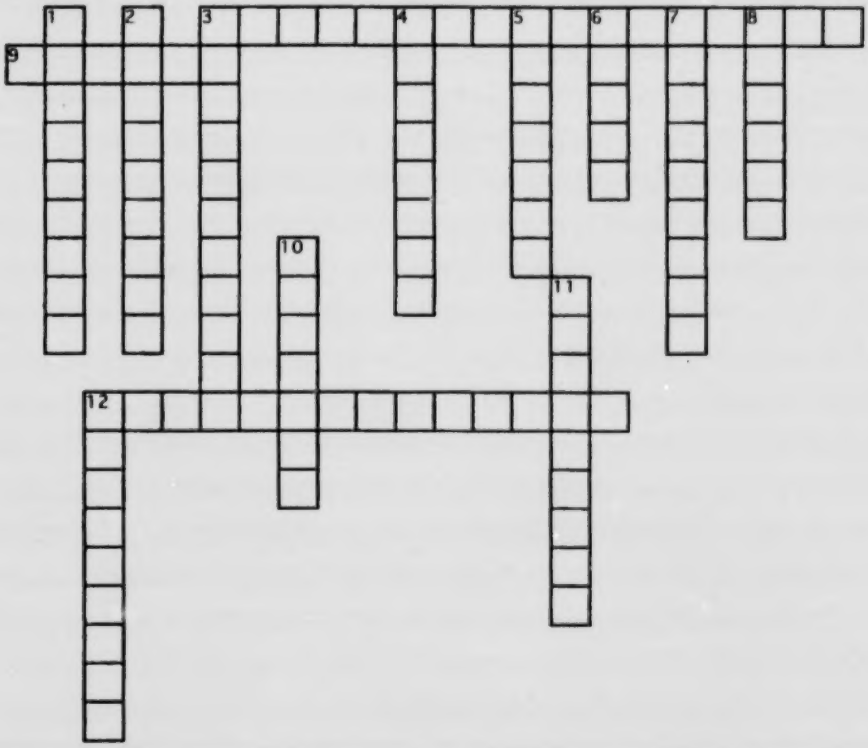
2. The small, erectile organ at the anterior part of the vulva that is similar to the penis in men
4. The prominent, skin-covered fat pad over the symphysis pubis that becomes covered with hair after puberty; also called the *mons veneris* (2 words)
7. The two bean-shaped glands on either side of the vaginal orifice that secrete lubricating fluid; also referred to as the *greater vestibular glands* (2 words)
9. The external opening of the urethra; also called the *urinary meatus* (2 words)
10. The flap of tissue covering the clitoris

DOWN

1. The external genitalia of women that comprises the mons pubis, labia majora, labia minora, clitoris, urinary orifice, vaginal orifice, and Bartholin's glands
3. The two outer, fatty longitudinal folds of skin on each side of the vaginal orifice that are covered with pigmented skin and hair on the outer surface but that are free of hair on the inside mucous lining (2 words)
5. The two longitudinal folds of epithelial tissue located within the labia majora that come together at their anterior in the prepuce of the clitoris (2 words)
6. The external opening of the uterus; also called the *vaginal meatus* (2 words)
8. The region between the vaginal orifice and the anus, composing the muscular floor of the pelvis

Crossword Puzzle 5—Terms from Objectives 15 Through 17

Name _____ Date _____



ACROSS

3. The glandular tissue of the breasts consisting of a series of lobes; each lobe has a system of ducts and sinuses for the passage of milk to the nipple (2 words)
9. The pigmented skin that surrounds a nipple
12. A series of events that take place in a nonpregnant woman between puberty and menopause that involves the release of an ovum and the shedding of the lining of the uterus occurring approximately every 28 to 30 days; the time covered by the process of menstruation (2 words)

DOWN

1. A protein hormone produced by the anterior lobe of the pituitary that induces lactation; a secretion that begins in response to a decrease of estrogen in the blood as a result of the expulsion of the placenta
2. A thin, yellowish secretion produced in the breasts; consists of maternal antibodies to boost the infant's immune system, white blood cells, water, protein, fat, minerals, vitamins, and carbohydrates
3. Of or pertaining to a structure that produces or conveys milk, such as the ducts of the breasts
4. A cavity or recess in an ovary that contains a liquor that divides follicular cells into layers that surrounds an ovum
5. Thousands of immature germ cells contained in the ovaries at birth
6. A dilated channel
7. The process of the synthesis and secretion of milk from the breasts
8. The small, round, pigmented structure that projects just below the center of each breast
10. _____ is indicated by the onset of ovulation and menstruation and the appearance of secondary sexual characteristics in the female
11. The release of an ovum by the ovaries
12. The cessation of ovulation and menstruation

Crossword Puzzle 6—Terms from Objective 18

Name _____ Date _____

ACROSS

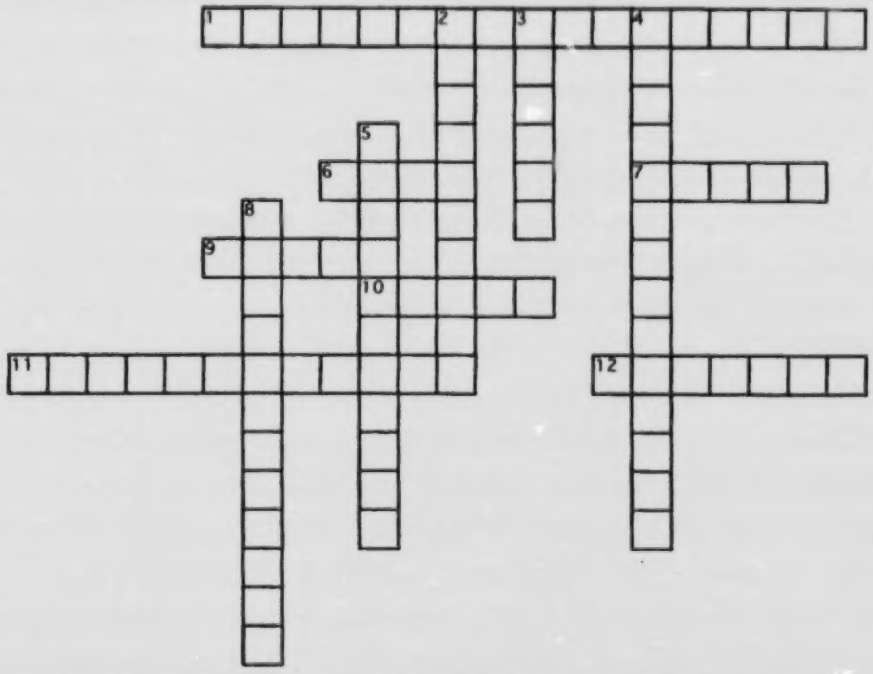
1. The onset of menstruation that occurs at puberty (10 to 16 years of age) and ceases permanently within the onset of menopause (40 to 50 years of age)
6. The _____ phase is the third phase of a menstrual cycle; usually occurs on the 14th day of the cycle; during this phase, the endometrium continues to thicken and the follicle ruptures and liberates an ovum that moves on to the fallopian tubes
7. The _____ phase is the first phase of a menstrual cycle; lasts 4 to 5 days; during this phase, there is a period of uterine bleeding accompanied by shedding of the endometrium and secretion of the follicle-stimulating hormone (FSH), causing a follicle to begin to develop in the ovary
8. The _____ phase is the fifth phase of a menstrual cycle; lasts 1 to 2 days; during this phase, the arteries constrict and the endometrium becomes anemic and shrinks; also, the corpus luteum begins to shrivel to form a structure called the *corpus albicans* and the production of progesterone is reduced

DOWN

1. A series of five phases that prepares the female body to become pregnant and then prepares it to try again if an ovum is not fertilized
2. A condition when women temporarily stop menstruating
3. The _____ phase is the second phase of a menstrual cycle; lasts 9 to 10 days; during this phase, the endometrium is repaired and thickens and the follicle continues to develop and secretes estrogen
4. The _____ phase is the fourth phase of a menstrual cycle; lasts 10 to 12 days; during this phase, the endometrium continues to thicken and prepare for the receipt of the ovum if it is fertilized; the corpus luteum—a gland that buds from the ruptured follicle—begins to develop and secrete progesterone
5. A gland that buds from the ruptured follicle during the luteal phase of the menstrual cycle (2 words)
9. A scar on the surface of the ovary that forms during the ischemic phase of the menstrual cycle (2 words)

Crossword Puzzle 7—Terms from Objectives 19 and 20

Name _____ Date _____



ACROSS

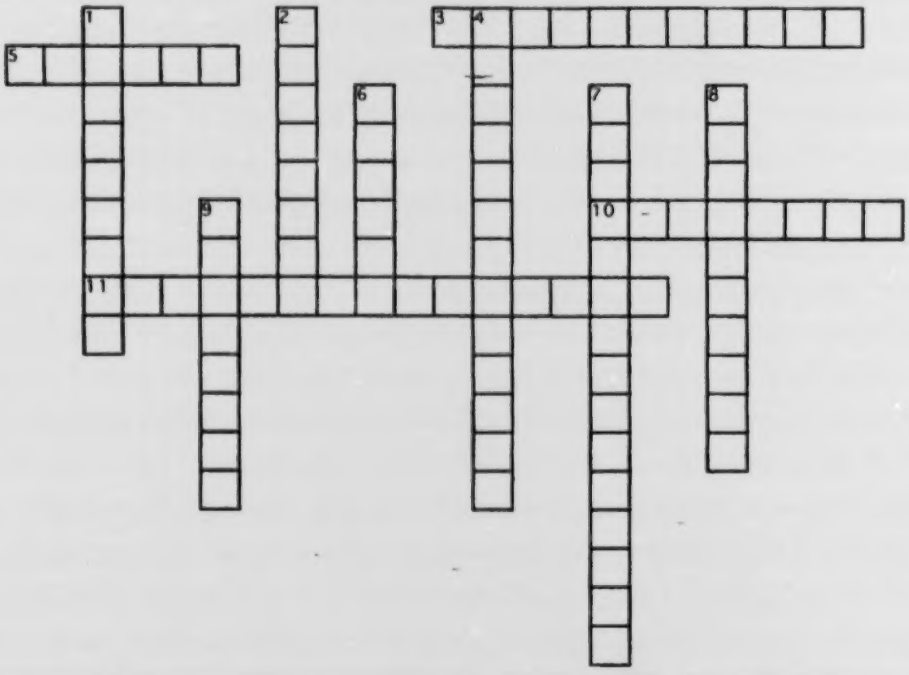
1. The removal of an organ, such as the ovaries or uterus, so as to interrupt the hormones or physiological structures that regulate menstruation (2 words)
6. A combining form meaning "of or related to the menses"
7. A combining form meaning "few" or "little"
9. A prefix meaning "of or related to the uterus"
10. A suffix meaning "fluid discharge or flow"
11. Pain associated with menstruation
12. A suffix meaning a "fluid discharge of excessive quantity"

DOWN

2. The absence of menstruation
3. The menstrual flow
4. Abnormally light or infrequent menstruation
5. Abnormally heavy or long menstrual periods
8. Uterine bleeding other than that caused by menstruation

Crossword Puzzle 8—Terms from Objectives 21 Through 23

Name _____ Date _____



ACROSS

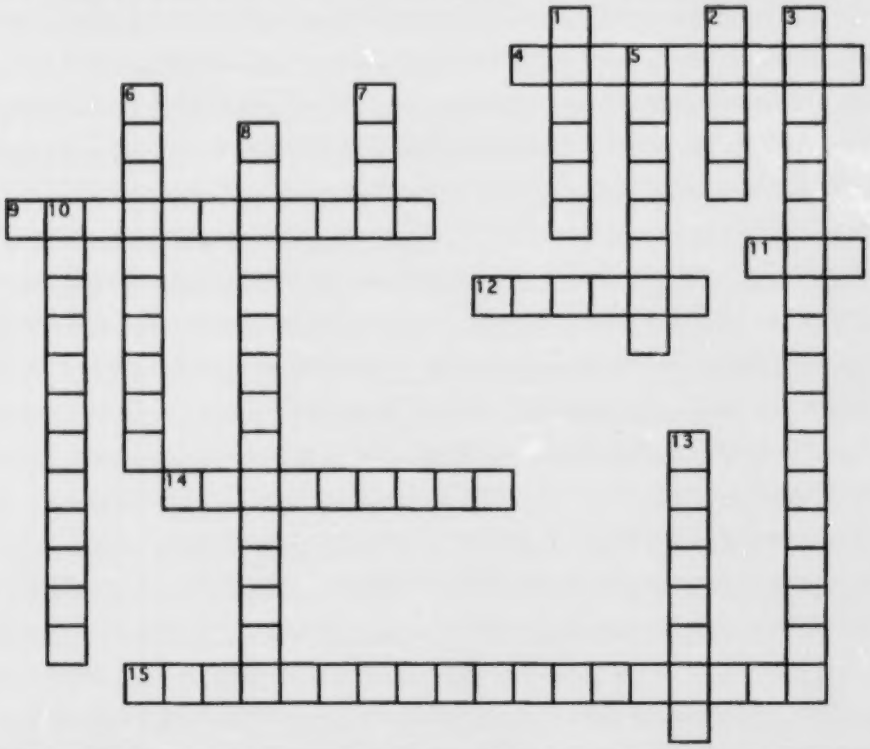
3. The process of childbirth
5. A solid mass of 16 cells that was previously the fertilized ovum
10. During this stage of labor and delivery the secretion of oxytocin by the posterior pituitary gland produces powerful contractions in the uterus that push the fetus from the uterus and out the birth canal (2 words)
11. The surgical procedure necessary to deliver a baby when the baby is too large or the cervix does not dilate adequately (2 words)

DOWN

1. _____ begins with fertilization; as soon as the sperm enters the ovum, cellular changes take place and the embryo begins to form; also called *gestation*
2. The head of a sperm
4. The serous fluid in which the fetus is immersed (2 words)
6. A sac formed by a thin membrane that surrounds the fetus; contains a serous fluid called *amniotic fluid*
7. The stage of the development of the fertilized ovum that follows the morula in which a hollow space develops within the mass of cells (2 words)
8. During this stage of labor and delivery continued uterine contractions expel the placenta from the uterus and out the birth canal (2 words)
9. During this stage of labor and delivery the secretion of progesterone decreases and the secretion of estrogen increases, causing weak, irregular contractions that force the amnion into the cervix; this dilates the cervix and eventually ruptures the amnion (2 words)

Crossword Puzzle 9—Terms from Objectives 24 and 25

Name _____ Date _____



ACROSS

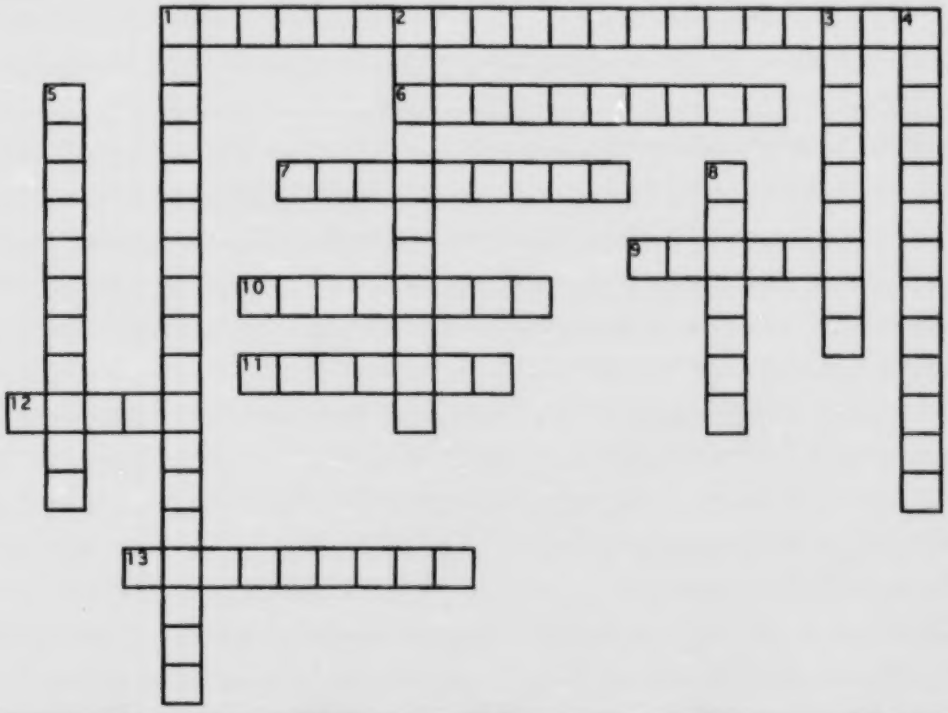
4. Delivery of the infant after less than 40 weeks of pregnancy is a _____ birth
9. _____ consist of deoxyribonucleic acid (DNA) and protein
11. _____ consists of four base compounds found in complementary pairs of adenine with thymine and guanine with cytosine
12. Each possibility for how a gene can affect an individual
14. The way the alleles of a gene are expressed or exhibited in an individual
15. _____ occur when a fertilized ovum splits; the fetuses only have one set of genes so they are genetically identical (2 words)

DOWN

1. Presentation of the infant at birth in any position other than head downward is a _____ birth
2. Delivery of a lifeless infant is a _____ birth
3. _____ occur when more than one ova is fertilized; the fetuses are genetically different (2 words)
5. Delivery of more than one infant from a pregnancy is _____ births
6. A _____ condition exists when the two alleles of a gene are the same
7. The segment of DNA for a protein
8. Delivery of an infant by surgically opening the abdomen and uterus (2 words)
10. A _____ condition exists when the two alleles of a gene are different
13. The similarity or difference in alleles of a gene

Crossword Puzzle 10—Terms from Objective 26

Name _____ Date _____



ACROSS

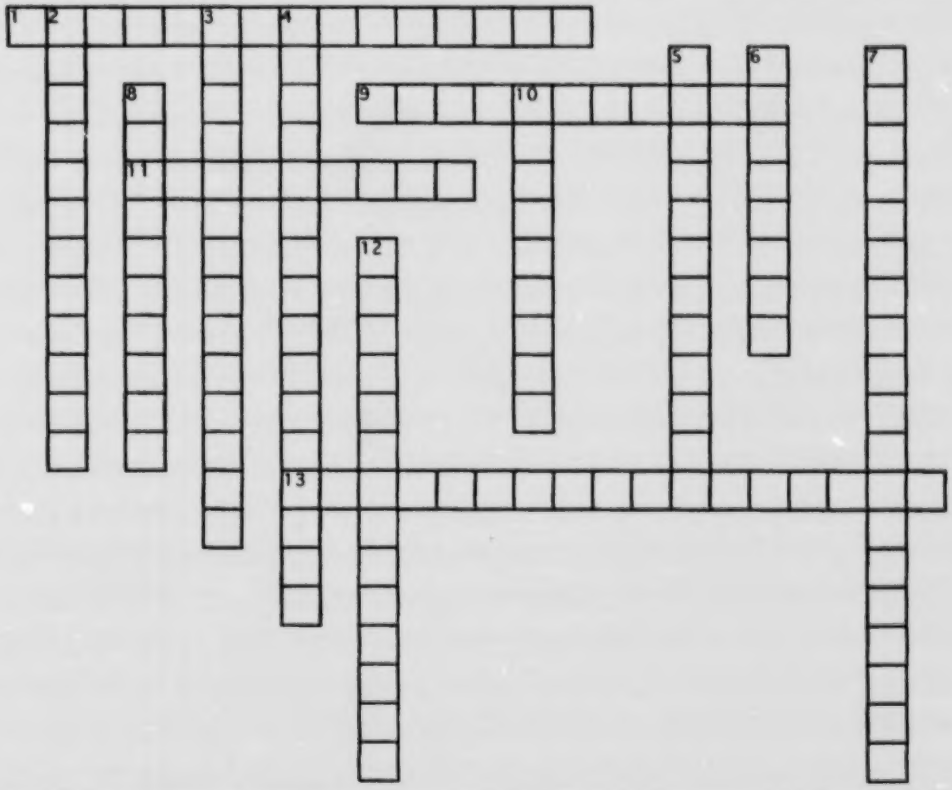
1. A collection of conditions, including irritability, depression, fatigue, weight gain, edema, headache, and nervousness, that may accompany the premenstrual cycle in some women (2 words)
6. A whitish discharge that accompanies some vaginal infections
7. An inflammation of the vagina
9. _____ cancer is cancer of the breast
10. _____ cancer is cancer of the cervix
11. _____ cancer is cancer of the ovaries
12. A common, benign tumor of the uterine muscle
13. The inability to reproduce

DOWN

1. Any inflammation of the female pelvic organs, especially one caused by bacterial infection is known as _____ *disease* (2 words)
2. An inflammation or infection of the uterine tubes
3. An inflammation of one or both ovaries
4. The presence of functioning endometrial tissue outside the uterus
5. A benign enlargement of the ovary often caused by a follicle that fails to rupture or a corpus luteum that fails to disintegrate (2 words)
8. _____ cancer is cancer of the uterus

Crossword Puzzle 11—Terms from Objective 26 (cont.)

Name _____ Date _____



ACROSS

1. A condition in which weakened uterine ligaments allow retroflexion of the uterus, which may then sink into the vagina (2 words)
9. The presence in the urine of abnormally large quantities of protein
11. Of or pertaining to the period immediately after childbirth
13. Separation of the placenta from the uterine wall after 20 weeks of pregnancy (2 words)

DOWN

2. An abnormal position of an organ in which the organ is tilted back acutely and folded over on itself
3. A condition of pregnancy in which the placenta is implanted abnormally in the uterus so that it impinges on or covers the cervical opening (2 words)
4. An abnormal pregnancy in which the embryo implants outside the uterine cavity (2 words)
5. A toxic condition of pregnancy characterized by hypertension, proteinuria, edema, hemorrhaging, and even stroke after the 24th week of pregnancy
6. An inflammation of the breast, usually caused by streptococcal or staphylococcal infection
7. The loss of an embryo or fetus before the 20th week of pregnancy; also referred to as *miscarriage* (2 words)
8. A bacterial infection of the blood
10. The gravest form of pregnancy-induced hypertension, characterized by convulsion, coma, hypertension, proteinuria, and edema
12. A bacterial infection of postpartum mothers that can progress to septicemia (2 words)

Answers to Crossword Puzzles

Crossword Puzzle 1

ACROSS
3. GENITALIA
9. FEMALE REPRODUCTIVE SYSTEM
10. ZYGOTE
11. FETUS

DOWN
1. GAMETE
2. FEMALE GONAD
4. EMBRYO
5. MENSTRUATION
6. FERTILIZATION
7. OVUM
8. OVA

Crossword Puzzle 2

ACROSS
2. FIMBRIAE TUBAE
7. VAGINA
9. OVARY
10. PROGESTERONE

DOWN
1. OVARIES
2. FALLOPIAN TUBES
3. BREASTS
4. ESTROGEN
5. UTERUS
6. ENDOMETRIUM
8. FALLOPIAN TUBE

Crossword Puzzle 3

ACROSS
4. UTERINE CAVITY
8. UTERUS
9. VAGINA
10. BODY

DOWN
1. FUNDUS
2. MENOPAUSE
3. ANTEVERSION
5. ANTEFLEXION
6. RETROVERSION
7. CERVIX

Crossword Puzzle 4

ACROSS
2. CLITORIS
4. MONS PUBIS
7. BARTHOLINS GLANDS
9. URINARY ORIFICE
10. PREPUCE

DOWN
1. VULVA
3. LABIA MAJORA
5. LABIA MINORA
6. VAGINAL ORIFICE
8. PERINEUM

Crossword Puzzle 5

ACROSS
3. LACTIFEROUS GLANDS
9. AREOLA
12. MENSTRUAL CYCLE

DOWN
1. PROLACTIN
2. COLOSTRUM
3. LACTIFEROUS
4. FOLLICLE
5. OOCYTES
6. SINUS
7. LACTATION
8. NIPPLE
10. PUBERTY
11. OVULATION
12. MENOPAUSE

Crossword Puzzle 6

ACROSS
1. MENARCHE
6. OVULATION
7. MENSTRUAL
8. ISCHEMIC

DOWN
1. MENSTRUAL CYCLE
2. AMENORRHEA
3. FOLLICULAR
4. LUTEAL
5. CORPUS LUTEUM
9. CORPUS ALBICANS

Crossword Puzzle 7

ACROSS
1. SURGICAL MENOPAUSE
6. MENO
7. OLIGO
9. METRO
10. RRHEA
11. DYSMENORRHEA
12. RRHAGIA

DOWN
2. AMENORRHEA
3. MENSES
4. OLIGOMENORRHEA
5. MENORRHAGIA
8. METRORRHAGIA

Crossword Puzzle 8

ACROSS
3. PARTURITION
5. MORULA
10. STAGE TWO
11. CESAREAN SECTION

DOWN
1. PREGNANCY
2. ACROSOME
4. AMNIOTIC FLUID
6. AMNION
7. BLASTOCYST STAGE
8. STAGE THREE
9. STAGE ONE

Crossword Puzzle 9

ACROSS
4. PREMATURE
9. CHROMOSOMES
11. DNA
12. ALLELE
14. PHENOTYPE
15. IDENTICAL MULTIPLES

DOWN
1. BREECH
2. STILL
3. FRATERNAL MULTIPLES
5. MULTIPLE
6. HOMOZYGOUS
7. GENE
8. CESAREAN SECTION
10. HETEROZYGOUS
13. GENOTYPE

Crossword Puzzle 10

ACROSS
1. PREMENSTRUAL SYNDROME
6. LEUKORRHEA
7. VAGINITIS
9. BREAST
10. CERVICAL
11. OVARIAN
12. MYOMA
13. STERILITY

DOWN
1. PELVIC INFLAMMATORY
2. SALPINGITIS
3. OOPHRITIS
4. ENDOMETRIOSIS
5. OVARIAN CYST
8. UTERINE

Crossword Puzzle 11

ACROSS
1. PROLAPSED UTERUS
9. PROTEINURIA
11. PUERPERAL
13. ABRUPTIO PLACENTAE

DOWN
2. RETROFLEXION
3. PLACENTA PREVIA
4. ECTOPIC PREGNANCY
5. PREECLAMPSIA
6. MASTITIS
7. SPONTANEOUS ABORTION
8. SEPTICEMIA
10. ECLAMPSIA
12. PUERPERAL FEVER

Module Review

Name _____

Date _____ Score _____

DIRECTIONS Read each of the items below. From the choices given, select the response that most correctly provides the required information. Circle the letter of the most-correct response.

Objective 22

1. If an ovum is fertilized by an X-bearing sperm, a _____ fetus will result.

   a. left-handed
   b. right-handed
   c. female
   d. male

Objective 10

2. After menopause, the uterus _____.

   a. shrivels and hardens
   b. continues to produce ova but does not release them
   c. becomes smaller and atrophies
   d. becomes smaller and disappears

Objective 26

3. A condition of pregnancy in which the placenta is implanted abnormally in the uterus so that it covers the cervical opening is called _____.

   a. *ectopic pregnancy*
   b. *prolapsed uterus*
   c. *placenta previa*
   d. *abruptio placentae*

Objective 15

4. The glandular tissue within the breasts becomes functional _____.

   a. at the female's birth
   b. at the onset of puberty
   c. after conception
   d. after delivery of an infant

Objective 6

5. Anther term for the womb is the _____.

   a. *vagina*
   b. *ova*
   c. *pelvic cavity*
   d. *uterus*

Objective 13

6. The structure indicated by the letter "W" in the illustration on the next page is the _____.

   a. fundus of the uterus
   b. fimbriae tubae
   c. fallopian tube
   d. ovarian ligament

Objective 13

7. The structure indicated by the letter "X" in the illustration on the next page is the _____.

   a. fundus of the uterus
   b. fimbriae tubae
   c. Bartholin's gland
   d. cervix of the uterus

Objective 13

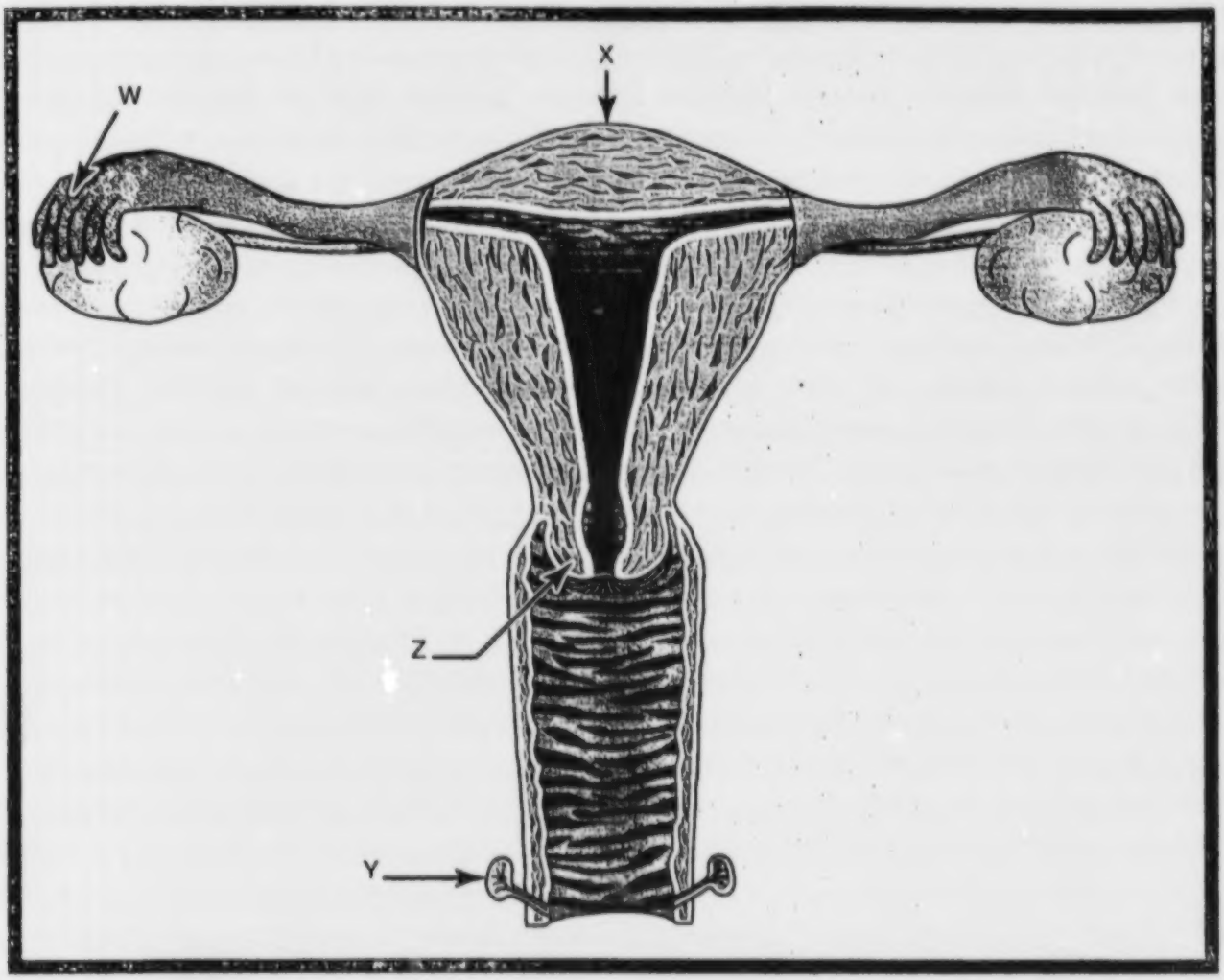
8. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

   a. fundus of the uterus
   b. fimbriae tubae
   c. Bartholin's gland
   d. cervix of the uterus

Objective 13

9. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

   a. fundus of the uterus
   b. fimbriae tubae
   c. Bartholin's gland
   d. cervix of the uterus



Objective 22

10. After about 3 days, a fertilized ovum has become a solid mass of 16 cells called the _____ and is _____.

    a. *morula*; firmly implanted in the uterine wall

    b. *morula*; nearing the opening of the fallopian tube into the uterus

    c. *blastocyst*; firmly implanted in the uterine wall

    d. *blastocyst*; nearing the opening of the fallopian tube into the uterus

Objective 10

11. The main functions of the uterus are involved with _____.

    a. pregnancy

    b. labor

    c. menstruation

    d. all of the above

Objective 8

12. The ovaries secrete _____.

    a. estrogen

    b. progesterone

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 26

13. Myoma is _____.

    a. a whitish discharge that accompanies some vaginal infections

    b. a benign tumor of the uterine muscle

    c. a benign enlargement of the ovary often caused by a follicle that fails to rupture or a corpus luteum that fails to disintegrate

    d. the presence of functioning endometrial tissue outside the uterus

Objective 15

14. The _____ of the breasts contain the openings for the milk ducts.

    a. fascia structures

    b. nipples

    c. lactiferous glands

    d. lacrimal glands

Objective 9

15. Each fallopian tube is approximately _____ inches long.

    a. 2

    b. 3

    c. 4

    d. 5

Objective 11

16. Which of the following statements is NOT correct with regard to the vagina?

    a. The vagina is a broad, muscular canal lined with mucous membrane.

    b. The vagina is situated behind the rectum and in front of the urethra and urinary bladder.

    c. The anterior wall of the vagina is approximately 2½ to 3 inches long.

    d. The posterior wall of the vagina is approximately 3 to 4 inches long.

Objective 22

17. The blastocyst enters the uterus _____ days after fertilization and secretes enzymes that eat into the _____.

    a. seven to eight; myometrium

    b. seven to eight; endometrium

    c. nine to ten; myometrium

    d. nine to ten; endometrium

Objective 18

18. Which of the following statements is correct with regard to the menstrual phase of menstruation?

    a. The menstrual phase is the period during which the follicle begins to develop in the ovary.

    b. The menstrual phase lasts 10 to 15 days.

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 10

19. The uterus contains and nourishes the embryo and the developing fetus from the time _____.

    a. the egg is fertilized until the time the egg is implanted

    b. the egg is fertilized until the time of delivery

    c. the fertilized egg is implanted until the start of labor

    d. the fertilized egg is implanted until the time of delivery

Objective 15

20. The breasts lie over the _____ muscle and each is attached to the muscle by a layer of connective fascia tissue.

    a. latissimus

    b. trapezius

    c. serratus anterior

    d. pectoralis

Objective 12

21. The _____ glands are two bean-shaped glands on either side of the vaginal orifice that secrete lubricating fluid.

    a. Skene's

    b. Bartholin's

    c. Cowper's

    d. bulbourethral

Objective 21

22. Which of the following is NOT a correct statement with regard to pregnancy?

    a. Two umbilical veins run through the umbilical cord to carry blood from the fetus to the capillaries of the fetal placenta, while the umbilical artery returns blood to the fetus.

    b. Pregnancy begins with fertilization.

    c. As soon as the sperm enters the ovum, cellular changes take place and the embryo begins to form.

    d. When the umbilical cord forms, it extends from the placenta to the embryo.

Objective 16

23. The structure indicated by the letter "X" in the illustration on the next page is the _____.

    a. adipose tissue

    b. lactiferous gland

    c. lactiferous sinus

    d. lactiferous duct

Objective 16

24. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

    a. adipose tissue

    b. lactiferous gland

    c. lactiferous sinus

    d. lactiferous duct

Objective 16

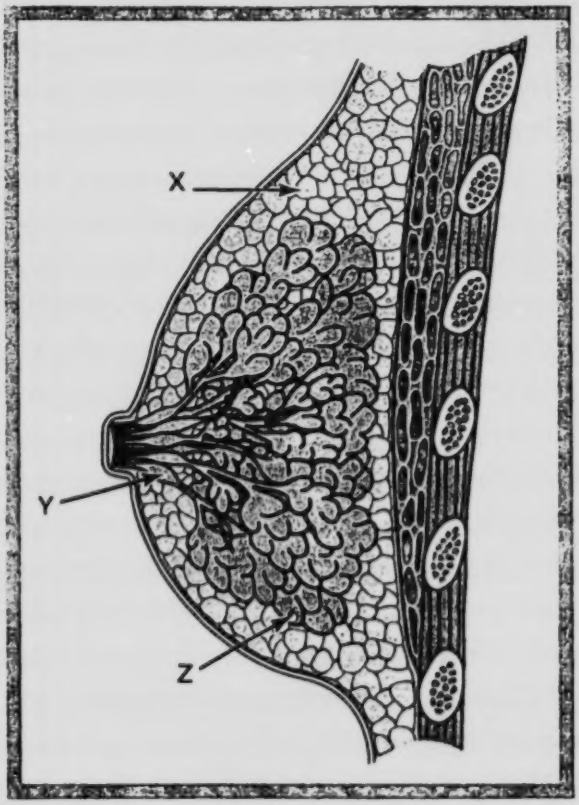
25. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

    a. adipose tissue

    b. lactiferous gland

    c. lactiferous sinus

    d. lactiferous duct



Objective 22

26. The sperm has the same number of pairs of chromosomes as the ovum, including _____ chromosomes.

a. a pair of X

b. a pair of Y

c. a pair of X or a pair of Y

d. a pair of X and a pair of Y

Objective 17

27. At birth, the ovaries contain _____ immature germ cells.

a. no

b. hundreds of

c. thousands of

d. millions of

Objective 11

28. The vagina is a collapsible tube that has folds of _____.

a. rugae

b. expandable connective tissue

c. striated muscle

d. mucous membrane between rings of cartilage

Objective 26

29. Inflammation of one or both of the ovaries is known as _____.

a. *premenstrual syndrome*

b. *salpingitis*

c. *oophritis*

d. *vaginitis*

Objective 12

30. The clitoris is _____.

a. the almond-shaped space between the lines of attachment of the labia minora

b. the opening of the vagina at the bottom of the vestibule, posterior to the urinary meatus

c. an erectile structure at the anterior part of the vulva

d. the region between the vaginal orifice and the anus, composing the muscular floor of the pelvis

Objective 22

31. What happens to form the blastocyst?

a. The 8-cell stage divides to form a 16-cell stage.

b. The 8-cell stage forms a hollow space within its mass.

c. The 16-cell stage divides to form a 32-cell stage.

d. The 16-cell stage forms a hollow space within its mass.

Objective 15

32. The mammary glands begin to secrete prolactin as a result of _____.

a. the baby attempting to nurse

b. pituitary hormones

c. discharge of the placenta

d. severing of the umbilical cord

Objective 10

33. If an egg is not implanted, the uterus will slough off the _____.

a. myometrium

b. endometrium

c. perineum

d. perimetrium

Objective 18

34. Which of the following is NOT a correct statement with regard to menstruation?

a. Menstruation ceases temporarily during pregnancy.

b. Menstruation always ceases during lactation.

c. Menstruation ceases permanently with the onset of menopause.

d. Menstruation may be disrupted due to emotional or hormonal disturbances, physical disorders, congenital disorders, malnutrition, and other factors.

Objective 20

35. _____ is the removal of an organ so as to interrupt the hormones or physiological structures that regulate menstruation.

a. Menopause

b. Surgical menopause

c. both "a" and "b"

d. neither "a" nor "b"

Objective 17

36. Puberty is indicated in the female by _____.

a. the onset of ovulation

b. the onset of menstruation

c. both "a" and "b"

d. neither "a" nor "b"

Objective 10

37. The lowest, constricted portion of the uterus is the _____.

a. fundus

b. cervix

c. body

d. trunk

Objective 19

38. Metrorrhagia is _____.

a. the absence of flow when normally expected

b. the scant flow

c. excessive flow and blood loss

d. uterine bleeding other than that caused by menstruation

Objective 7

39. The structure indicated by the letter "W" in the illustration on the next page is the _____.

a. fallopian tube

b. ovary

c. uterus

d. vagina

Objective 7

40. The structure indicated by the letter "X" in the illustration on the next page is the _____.

a. fallopian tube

b. ovary

c. uterus

d. vagina

Objective 7

41. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

a. fallopian tube

b. ovary

c. uterus

d. vagina

Objective 7

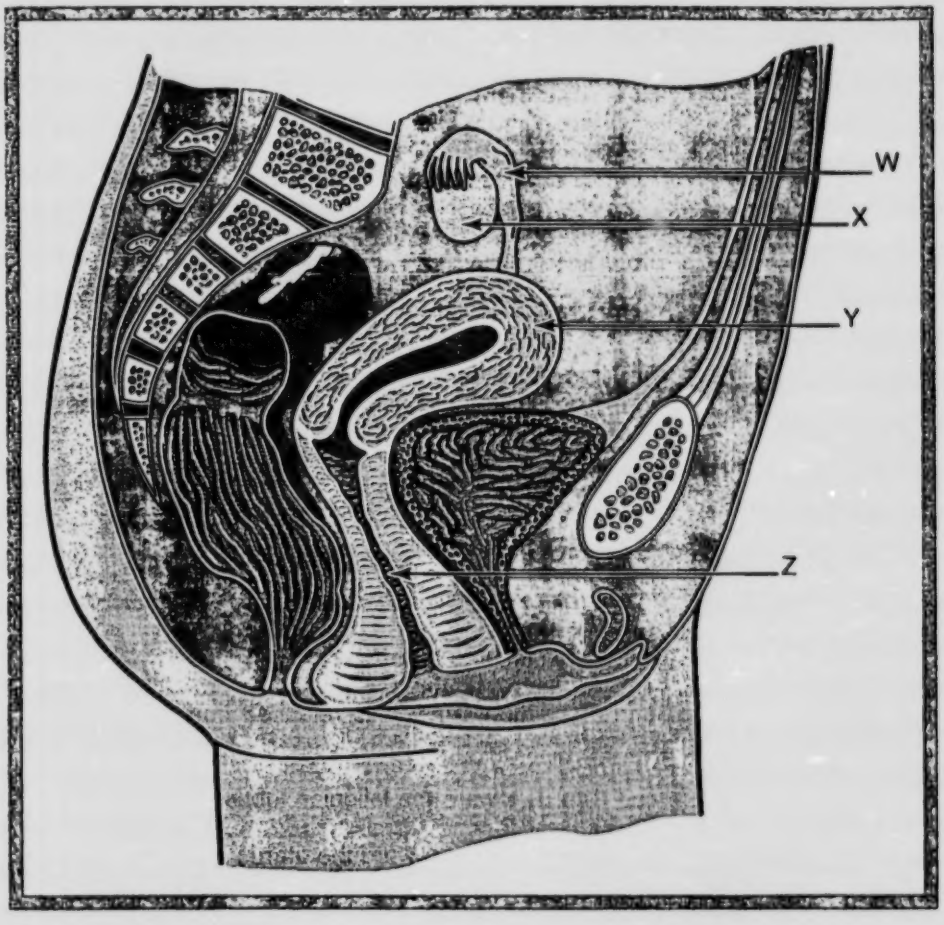
42. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

a. fallopian tube

b. ovary

c. uterus

d. vagina



Objective 15

43. The nipples are surrounded by a circular pigmented area called the _____.

a. *areola*

b. *alveoli*

c. *areolar*

d. *auricle*

Objective 21

44. The fetus floats in a sac of _____.

a. water

b. amniotic fluid

c. intercellular fluid

d. vaginal fluid

Objective 18

45. Which of the following statements is correct with regard to the menstrual phase of menstruation?

    a. The menstrual phase is the period of uterine bleeding accompanied by shedding of the endometrium.

    b. The menstrual phase is the period during which the follicle begins to develop in the ovary.

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 21

46. The fetus is delivered when the cervix of the uterus _____ enough to allow the fetus to be pushed into the vaginal canal by the muscles of the fundus and body of the uterus and the muscles of the vagina.

    a. dilates and flattens

    b. shrinks and flattens

    c. sinks low

    d. rises high

Objective 22

47. During ovulation, an egg is released from the ovary and begins moving down the _____.

    a. uterus toward the fallopian tubes

    b. fallopian tube toward the uterus

    c. fallopian tube toward the uterine tube

    d. uterine tube toward the fallopian tube

Objective 15

48. The _____ glands secrete milk.

    a. Bartholin

    b. vestibular

    c. lacrimal

    d. lactiferous

Objective 18

49. Menstrual discharge consists of _____.

    a. serous fluid

    b. blood

    c. both "a" and "b"

    d. neither "a" nor "b"

Objective 10

50. _____ is an abnormal backward bending of the fundus and body at the cervix, with the position of the cervix usually unchanged.

a. Retroversion

b. Anteversion

c. Retroflexion

d. Anteflexion

Objective 18

51. The onset of menstruation is caused by _____.

a. the increase in ovarian hormones when the ovum is fertilized

b. the reduction of ovarian hormones when the ovum is fertilized

c. the increase of ovarian hormones when the ovum is not fertilized

d. the reduction of ovarian hormones when the ovum is not fertilized

Objective 22

52. As a spermatozoon makes its way through the fluid of the uterus and fallopian tube, it _____, which results in the _____ of the sperm fracturing.

a. capacitates; acrosome

b. decapitates; acrosome

c. capacitates; flagellum

d. decapitates; flagellum

Objective 10

53. The convex, rounded, superior portion of the uterus is the _____.

a. fundus

b. cervix

c. body

d. trunk

Objective 22

54. When the nuclei of the sperm and ovum fuse, the cell begins dividing, forming a _____.

a. two-cell stage within 12 hours and a four-cell stage within 24 hours

b. four-cell stage within 12 hours and an eight-cell stage within 24 hours

c. two-cell stage within 24 hours and a four-cell stage within 36 hours

d. two-cell stage within 36 hours and a four-cell stage within 48 hours

Objective 23

55. The third stage of labor and delivery occurs as continued uterine contractions _____.

a. expel the fetus from the uterus and out the birth canal

b. expel the placenta from the uterus and out the birth canal

c. subside and the mother begins lactating

d. cause the empty uterus to return to near normal size

Objective 14

56. The structure indicated by the letter "W" in the illustration on the next page is the _____.

a. vulva

b. clitoris

c. mons pubis

d. perineum

Objective 14

57. The structure indicated by the letter "X" in the illustration on the next page is the _____.

a. vulva

b. clitoris

c. mons pubis

d. perineum

Objective 14

58. The structure indicated by the letter "Y" in the illustration on the next page is the _____.

a. vulva

b. clitoris

c. mons pubis

d. perineum

Objective 14

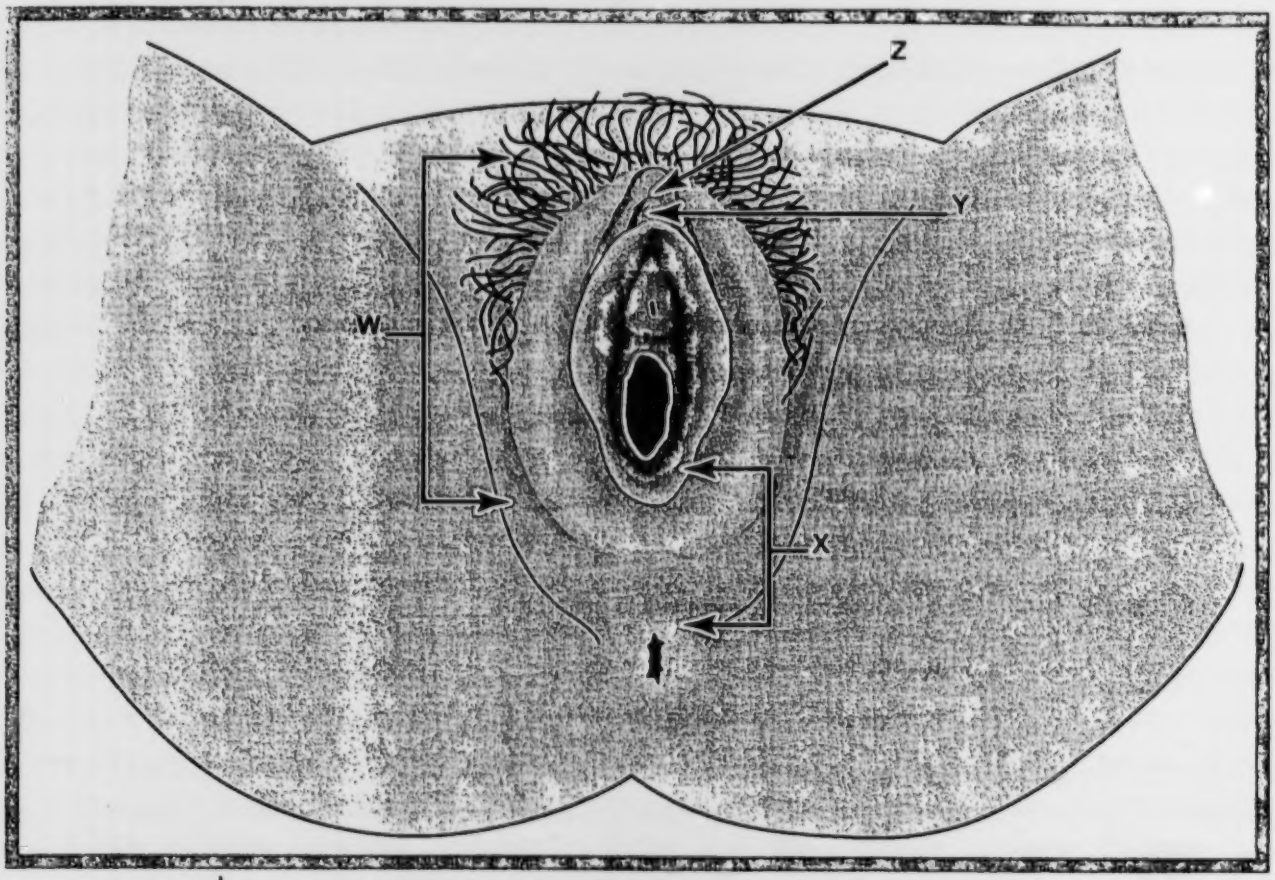
59. The structure indicated by the letter "Z" in the illustration on the next page is the _____.

a. vaginal meatus

b. clitoris

c. prepuce

d. urinary meatus



Objective 18

60. Which of the following statements is correct with regard to the ovulation phase of the menstrual cycle?

a. The ovulation phase is the period in which the endometrium ceases its growth.

b. The ovulation phase is the period during which the follicle ruptures and liberates an ovum that moves on to the fallopian tubes.

c. both "a" and "b"

d. neither "a" nor "b"

Objective 22

61. The thin membrane that forms around the developing embryo is called the _____.

a. *anion*

b. *amino*

c. *amnion*

d. *axiom*

Objective 25

62. Each possibility for how a gene can affect an individual is called an _____ and there are at least _____ for each gene.

a. *allele*; two alleles

b. *allele*; four alleles

c. *amine*; two amines

d. *amine*; four amines

Objective 23

63. During the first stage of labor and delivery, the amniotic sac _____.

a. dilates

b. shrinks

c. ruptures

d. inflates

Objective 2

64. The mature female germ cell is called the _____.

a. *ovum*

b. *zygote*

c. *embryo*

d. *fetus*

Objective 22

65. Weeks 9 through 40 of fetal development are known as the _____.

a. *mid-term*

b. *second trimester*

c. *fetal stage*

d. *embryonic phase*

Objective 23

66. During the first stage of labor and delivery, the secretion of progesterone _____ and the secretion of estrogen _____, causing weak, irregular contractions that force the _____ into the cervix.

a. decreases; increases; amnion

b. increases; decreases; amnion

c. decreases; increases; fetus

d. increases; decreases; fetus

Objective 17

67. The female gonads usually become inactive at about _____ years of age.

a. 35

b. 45

c. 60

d. 65

Objective 22

68. During the first eight weeks after becoming implanted in the uterus, embryonic development forms the _____.

a. embryonic disc

b. embryonic bud

c. embryo

d. fetus

Objective 23

69. During the second stage of labor and delivery, the secretion of _____ by the posterior pituitary gland produces powerful contractions in the uterus that push the fetus from the uterus and out the birth canal.

a. progesterone

b. estrogen

c. oxytocin

d. testosterone

Objective 1

70. The female _____ is the female gonads, the associated ducts and organs, and the external genitalia that function in the procreation of offspring.

a. zygote

b. fertilization system

c. menstruation system

d. reproductive system

Objective 25

71. Except for ova, sperm, and mature red blood cells, cells of the human body contain _____ chromosomes.

a. 22

b. 23

c. 46

d. 48

Objective 5

72. The major divisions of the female reproductive system are _____.

a. ovaries, fallopian tubes, uterus

b. vulva, mons pubis, labia

c. internal, external, breasts

d. lactiferous sinus, ducts, and glands

Objective 25

73. Each cell has one pair of sex chromosomes. The remaining chromosomes are called _____.

a. *acrosomes*

b. *autosomes*

c. *lysosomes*

d. *cytosomes*

Objective 10

74. Which of the following statements describes the normal position of the cervix?

a. The cervix points toward the upper end of the sacrum with the fundus inclined back away from the suprapubic region.

b. The cervix points toward the upper end of the sacrum with the fundus inclined forward toward the suprapubic region.

c. The cervix points toward the lower end of the sacrum with the fundus inclined back away from the suprapubic region.

d. The cervix points toward the lower end of the sacrum with the fundus inclined forward toward the suprapubic region.

Objective 24

75. Presentation of the infant at birth in any position other than head downward is referred to as _____.

a. *cesarean section*

b. *breech birth*

c. *still birth*

d. *multiple birth*

Objective 19

76. Painful menstruation is called _____.

a. *amenorrhea*

b. *oligomenorrhea*

c. *dysmenorrhea*

d. *menorrhagia*

Objective 24

77. Premature birth is delivery of the infant after less than _____ weeks of pregnancy.

a. 36

b. 38

c. 40

d. 42

Objective 4

78. Which of the following is NOT a function of the female reproductive system?

a. perpetuation of the human species

b. development of the fetus

c. sexual gratification

d. storage of surplus nutrients

Objective 25

79. Chromosomes consist of _____.

a. deoxyribonucleic acid

b. protein

c. both "a" and "b"

d. neither "a" nor "b"

Objective 3

80. The union of the male gamete and female gamete to form _____ is called *fertilization.*

a. an ovum

b. a zygote

c. an embryo

d. a fetus

Objective 25

81. Which of the following is the correct pairings of bases in DNA?

a. adenine with thymine, guanine with cytosine

b. adenine with guanine, thymine with cytosine

c. adenine with cytosine, guanine with thymine

d. none of the above

Objective 18

82. The onset of menstruation is referred to as _____.

a. *menarche*

b. *menses*

c. *meiosis*

d. *menopause*

Objective 6

83. An ovary is one of a pair of internal female reproductive organs found on either side of the _____.

a. vagina

b. ova

c. pelvic cavity

d. uterus

Objective 25

84. The four base compounds in DNA create proteins, and the segment of DNA for a protein is called _____.

a. *ribonucleic acid*

b. a *messenger RNA*

c. a *gene*

d. a *nucleotide*

Objective 8

85. The main functions of the ovaries are to _____.

a. produce, develop, mature, and discharge the female gametes and to secrete female hormones

b. hold the female gametes for fertilization and then discharge them into the uterine tubes

c. prevent spermatozoa from reaching the female gametes until the uterus is ready

d. hold, nourish, and develop the fetus until time for delivery

Objective 17

86. For approximately the first _____ months of embryonic life, no sexual differentiation is evident.

a. two

b. three

c. four

d. five

Objective 25

87. What creates a code that determines the inherited characteristics of an individual?

a. the arrangement of the base compounds within the segment of protein DNA

b. the number of the base compounds within the segment of protein DNA

c. the number of segments of DNA in a protein

d. the arrangement of the chromosomes within the segments of protein DNA

Objective 9

88. The margin of each distal end of a fallopian tube is funnel-shaped and consists of a number of finger-like projections called the _____.

a. *vulva*

b. *fimbriae tubae*

c. *labia majora*

d. *labia minora*

Objective 25

89. When the genetic possibilities are the same, a _____ condition exists, while a _____ condition exists if the genetic possibilities are different.

a. hypozygous; hyperzygous

b. hyperzygous; hypozygous

c. homozygous; heterozygous

d. heterozygous; homozygous

Objective 22

90. When the head of the sperm fractures, it releases _____ that eat through the outer wall of the ovum when the sperm contacts it, allowing the sperm to enter the ovum.

a. acids

b. enzymes

c. catalysts

d. alkalines

Objective 10

91. Which of the following is NOT a correct statement about the uterus?

a. The uterus is a muscular organ located in the pelvic cavity anterior to the rectum and posterior to the urinary bladder.

b. The uterus is firmly attached to the skeleton and suspended in the pelvic cavity by various ligaments.

c. The uterus is approximately 2 inches wide at the upper end and about 1 inch thick.

d. The uterus becomes enormously enlarged during pregnancy, increasing to 8 to 10 inches in width.

Objective 25

92. The similarity or difference in genetic possibilities is referred to as the _____.

a. *phenotype*

b. *genotype*

c. *archetype*

d. *stereotype*

Objective 11

93. Which of the following is NOT a function of the vagina?

a. to receive the penis during copulation

b. to hold the menstrual flow until an ovum is available

c. to serve as the lower part of the birth canal by stretching to allow the passage of the fetus

d. to act as the excretory duct for uterine secretions and menstrual flow

Objective 25

94. The way genetic possibilities are expressed or exhibited in an individual is referred to as the _____.

a. *phenotype*

b. *genotype*

c. *archetype*

d. *stereotype*

Objective 22

95. The ovum has _____ pairs of chromosomes, including one pair of _____ chromosomes that contribute to sexual characteristics.

a. 22; Z

b. 23; X

c. 22; Y

d. 23; Y

Objective 8

96. Which of the following is NOT a true statement about the ovaries?

a. Each of the two ovaries resembles an egg in size and shape.

b. The ovaries are located on either side of the uterus and are attached to the back of the broad ligament behind and below the fallopian tubes.

c. Each ovary lies between the folds of the broad ligament.

d. The ovaries are anchored to the uterus by the ovarian ligament.

Objective 25

97. The genetic possibility that is most likely to occur is referred to as a _____ *trait.*

a. *paternal*

b. *maternal*

c. *dominant*

d. *recessive*

Objective 9

98. The _____ provide an area where an ovum is nourished and delayed for fertilization.

a. ovaries

b. ovarian ligaments

c. Bartholin's glands

d. fallopian tubes

Objective 25

99. If the genetic code is not properly duplicated in an individual, the resulting change is called a _____.

a. *mitosis*

b. *meiosis*

c. *mutagen*

d. *mutation*

Objective 10

100. The uterus becomes smaller after delivery, but is always _____ than before pregnancy.

a. much smaller

b. slightly smaller

c. slightly larger

d. much larger

Objective 21

101. An average pregnancy is approximately _____ days.

a. 240

b. 260

c. 280

d. 300

Objective 18

102. Which of the following statements is NOT true with regard to menstruation?

a. Menstruation begins at puberty.

b. The menstrual cycle lasts 18 to 21 days on the average.

c. Menstruation may be disrupted due to emotional or hormonal disturbances, physical disorders, congenital disorders, malnutrition, and other factors.

d. Menstruation lasts until menopause.

Objective 21

103. The mother performs the function of waste elimination and food acquisition for the growth of the fetus by _____ through the placental membranes.

a. diffusion

b. hydrolysis

c. osmosis

d. effusion

Objective 12

104. The prominent, skin-covered fat pad over the symphysis pubis that becomes covered with hair after puberty is the _____.

a. mons pubis

b. vulva

c. labia majora

d. labia minora

Objective 22

105. The entry of the sperm nucleus into an ovum causes the membrane of the ovum to change, _____.

a. so that the ovum begins immediate cell division

b. preparing for additional sperm

c. thickening to double the size of the ovum

d. preventing the entry of other sperm

Objective 25

106. One chromosome in each pair originated in the ovum and is referred to as a _____ *chromosome*, while the second chromosome of the pair originated in the sperm and is called a _____ *chromosome*.

a. *maternal; paternal*

b. *paternal; maternal*

c. *maternal; fraternal*

d. *fraternal; maternal*

Objective 18

107. Which of the following statements is correct with regard to the follicular phase of menstruation?

a. The follicular phase is the period in which the endometrium is repaired and thickens.

b. The follicular phase is the period during which the follicle continues to develop and secretes estrogen.

c. both "a" and "b"

d. neither "a" nor "b"

Objective 10

108. Which of the following statements is NOT correct about the uterus?

a. The uterine cavity is small because of the thickness of the muscular walls.

b. The uterine cavity is triangular in shape with an opening in each angle of the triangle, including the fallopian tubes at the top two angles of the triangle and the opening to the cervix below.

c. The uterus is a suspended structure.

d. The uterine cavity is totally sealed until puberty and then seals again after menopause.

Objective 26

109. _____ is a toxic condition of pregnancy characterized by hypertension, proteinuria, edema, hemorrhaging, and even stroke after the 24th week of pregnancy.

a. Preeclampsia

b. Puerperal fever

c. Mastitis

d. none of the above

Objective 18

110. Which of the following statements is correct with regard to the ischemic phase of menstruation?

a. The ischemic phase is the period in which the arteries constrict and the endometrium becomes anemic and shrinks.

b. The ischemic phase is the period during which the corpus luteum shrivels and the production of hormones—especially progesterone—increases.

c. both "a" and "b"

d. neither "a" nor "b"

Answers to Module Review

1. c	23. a	45. c	67. b	89. c
2. c	24. c	46. a	68. a	90. b
3. c	25. b	47. b	69. c	91. b
4. d	26. c	48. d	70. d	92. b
5. d	27. c	49. c	71. c	93. b
6. b	28. a	50. a	72. c	94. a
7. a	29. c	51. d	73. b	95. b
8. c	30. c	52. a	74. d	96. a
9. d	31. d	53. a	75. b	97. c
10. b	32. c	54. d	76. c	98. d
11. d	33. b	55. b	77. c	99. d
12. c	34. b	56. a	78. d	100. c
13. b	35. b	57. d	79. c	101. c
14. b	36. c	58. b	80. b	102. b
15. c	37. b	59. c	81. a	103. c
16. b	38. d	60. b	82. a	104. a
17. b	39. a	61. c	83. d	105. d
18. a	40. b	62. a	84. c	106. a
19. d	41. c	63. c	85. a	107. c
20. d	42. d	64. a	86. a	108. d
21. b	43. a	65. c	87. a	109. a
22. a	44. b	66. a	88. b	110. a

Anatomy and Physiology

Module Set II:
Major
Body Systems

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Surgical Technology

Anatomy and Physiology

Module Set II:
Major Body Systems

Student Edition

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Contents

MODULES WITHIN SET

Module 1: Integumentary System

Module 2: Skeletal System

Module 3: Muscular System

Module 4: Nervous System

Module 5: Endocrine System

Module 6: Special Senses

Module 7: Circulatory System—Blood

Module 8: Circulatory System—Cardiac

Module 9: Circulatory System—Vascular

Module 10: Lymphatic System

Module 11: Respiratory System

Module 12: Digestive System

Module 13: Urinary System

Module 14: Reproductive System—Male

Module 15: Reproductive System—Female

1012

MODULE SET II:
Major Body Systems

Module 1: Integumentary System

1013

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheets	
1—Practice Critical Thinking: Investigate Skin Cancer	19
2—Practice Critical Thinking: Investigate Burns	21

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 14.
- ❑ 5. **Research** Online resources to learn more about the integumentary system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Investigate Skin Cancer."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Do** Assignment Sheet 2, "Practice Critical Thinking: Investigate Burns."
- ❑ 11. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 12. If the evaluation is not satisfactory, repeat step 10.
- ❑ 12. **Check** With your instructor for any additional assignments to be completed.

❑ 13.	**Do**	Additional assignments your instructor lists below.
❑ 14.	**Take**	Module Review provided by your instructor.
❑ 15.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 16.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheets, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the integumentary system, state the functions of the major structures of the integumentary system, and define common disorders and abnormalities of the integument. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *integument.*
2. List the major structures that make up the integument.
3. Complete statements that describe the characteristics of the skin.
4. List the functions of the skin.
5. Describe the major structures of the skin.
6. Match the layers of the epidermis to their correct descriptions.
7. Distinguish between descriptions of the layers of the dermis.
8. Define the term *auxiliary appendage.*
9. Complete statements that describe the characteristics of hair.
10. Complete statements that describe the characteristics of nails.
11. State the functions of the glands located in the skin.
12. List the types of nerve endings found in the skin.
13. Label the major structures of the integument.
14. Match common disorders and abnormalities of the integument to their correct definitions.
15. Practice critical thinking: investigate skin cancer. (Assignment Sheet 1)
16. Practice critical thinking: investigate burns. (Assignment Sheet 2)

Information Sheet

OBJECTIVE 1 **Define the term *integument*.**

- **Integument** (in-teg´-yuh-muhnt)—The structures that cover the exposed surfaces o the body (see Figure 1)

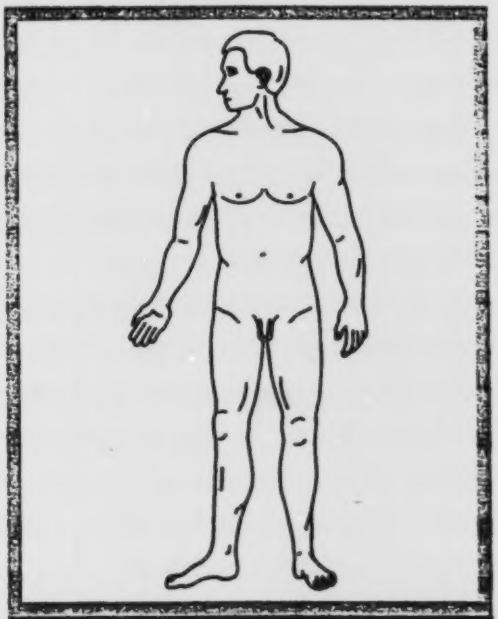


Figure 1
Integumentary system

OBJECTIVE 2 **List the major structures that make up the integument.**

1. **Skin**

   ✔ **NOTE:** The major structures of the skin are the epidermis, the dermis (true skin), and the hypodermis. You will study these structures in Objective 3 through Objective 7.

2. **Auxiliary** (awg-zil´-uh-re) **appendages**

   ✔ **NOTE:** The auxiliary appendages of the integument include the hair and nails and several other structures. You will study the auxiliary appendages in Objective 8 through Objective 12.

OBJECTIVE 3 **Complete statements that describe the characteristics of the skin.**

1. **The skin is the largest organ of the body.**
2. **Skin varies in depth over the body.**

3. **If skin is kept clean, it is the body's first line of defense against disease.**

4. **The skin connects to mucous membranes where it joins body cavities.**

5. **Skin color is the result of melanin and the amount of blood near the surface of the skin.**

   ✔ **NOTE:** Melanin gives color to the hair and eyes as well as the skin. The greater the deposits of melanin, the darker the skin will appear. However, skin color is also affected by the amount of blood near the surface. For example, when someone exercises, blood circulation increases, which can give the skin a red appearance as the blood vessels dilate to support the increased flow. On the other hand, if a person experiences a trauma, the blood may pool in the vital organs, causing the skin to look pale.

KEY TERM

Melanin (mel´-uh-nuhn)—A protein that absorbs ultraviolet light to give coloration to body structures; also referred to as a *pigment*

OBJECTIVE 4 **List the functions of the skin.**

1. **Provides a mechanical barrier against microorganisms, sunlight, and chemicals to protect the body**

2. **Houses nerve endings that sense pain, temperature, touch, and pressure**

3. **Helps to regulate body temperature**

   ✔ **NOTE:** When the body is warm, the skin releases sweat to remove heat from the body and to provide cooling through evaporation. When the skin senses cold, it closes off its pores to prevent heat loss. The muscles attached to body hair may also tighten, causing gooseburnps. In fur-bearing animals, the same response would improve the insulating abilities of the animal's fur.

4. **Excretes waste materials**

5. **Helps maintain fluid and electrolyte balance**

   ✔ **NOTE:** The skin is a selectively permeable membrane. Sweat carries electrolytes with it so that electrolyte balance does not change too drastically during normal perspiration.

OBJECTIVE 5 **Describe the major structures of the skin** (see Figure 2 on page 15).

1. **Epidermis** (ep-uh-duhr´-muhs)—The thin, nonvascular, nonsensitive outermost layer of the skin, consisting of stratified squamous epithelial tissue and including as the greater part of its thickness dead cells that are scraped off and replaced by the underlying cells

✔ **NOTE:** The epidermis serves to protect the body. It consists of four layers (see Objective 6), except on the palms of the hands and the soles of the feet, where there are five layers. The structure is easily expendable; the loss of the epidermis is simply the loss of cells that are already dead. The epidermis is the thickest on the soles of the feet and is thinnest on the eyelids, forehead, and penis.

2. **Dermis** (duhr´-muhs)—The thick, **vascular**, **sensitive** layer of the skin just below the epidermis, consisting of dense, fibrous connective tissue and containing the auxiliary appendages of the skin

   ✔ **NOTE:** The dermis consists of two layers (see Objective 7). The auxiliary appendages of the skin include hair and sweat glands.

3. **Dermal-epidermal** (duhr´-muhl ep-uh-duhr´-muhl) **junction**—A **polysaccharide** gel with fibrous structures that serve as a cement to hold the layers of the skin together

KEY TERMS

Vascular (vas´-kyuh-luhr)—Containing blood or lymph vessels

Sensitive (sen´-suht-iv)—Containing nerve endings and, therefore, can feel sensation

Polysaccharide (pawl-e-sak´-uh-rid)—A carbohydrate that contains three or more molecules of simple carbohydrates

4. **Hypodermis** (hi-puh-duhr´-muhs)—The layer of **areolar tissue** and fat that lies beneath the dermis and exhibits varying amounts of fat content depending on factors such as body location, gender, nutrition, and health

   ✔ **NOTE:** The hypodermis is also called the ***subcutaneous layer***, *subcutaneous fascia*, or *superficial fascia.*

KEY TERMS

Areolar (uh-re´-uh-luhr) **tissue**—A kind of connective tissue having little tensile strength and consisting of loosely woven fibers and **areolae**

Areola (uh-re´-uh-luh)—A small space or a cavity within a tissue

Subcutaneous (suhb-kyu-ta´-ne-uhs)—Beneath the skin

Fascia (fash´-uh)—The fibrous connective tissue of the body

✔ **NOTE:** The fascia varies in thickness and density and in the amount of fat, collagenous fiber, elastic fiber, and tissue fluid it contains. Kinds of fasciae are deep fascia, subcutaneous fascia, and subserous fascia.

OBJECTIVE 6

Match the layers of the epidermis to their correct descriptions.

✔ **NOTE:** Depending on the location in the body, the epidermis has either four or five layers. Because the layers of the epidermis have no vascular network, they are supported by the nutrients of the dermis. As the layers progress out from the dermis, they receive fewer and fewer nutrients and none in the outermost layer.

1. **Stratum corneum**—The outermost layer of the epidermis where dead cells have been converted into **keratin** that continually flakes off (see Figure 2 on page 15)

2. **Stratum lucidum**—The water-repellent, transparent inner layer of the epidermis found only on the palms of the hands and the soles of the feet

   ✔ **NOTE:** The thin squamous cells of the stratum lucidum do not contain cytoplasm or nuclei but, instead, consist of keratin, which is water repellent. Without this water-repellent layer, humans would not be able to spend more than a few minutes in water before cell damage would occur.

KEY TERMS

Stratum (strat´-uhm)—The Latin term for "layer"

✔ **NOTE:** Each of the layers of the epidermis is referred to by the term *stratum* and a Latin adjective that describes the layer further.

Corneum (kor´-ne-uhm)—The Latin term for "horn"

✔ **NOTE:** The stratum corneum is sometimes referred to as the *horny layer* because it is essentially a crust of dead cells.

Keratin (ker´-uht-uhn)—A fibrous, sulfur-containing protein that is the primary component of the epidermis, hair, nails, and enamel of the teeth

Lucidum (lu´-sid-uhm)—The Latin term for "clear"

3. **Stratum granulosum**—The inner layer of the epidermis with dying cells that develop granules of **keratohyalin** in their cytoplasm (see Figure 2 on page 15)

   ✔ **NOTE:** The stratum granulosum usually consists of from two to four sublayers and is often missing in areas of thin skin, such as the eyelids.

KEY TERMS

Granulosum (gran-yuh-lo´-suhm)—The Latin term for "granular"

Keratohyalin (ker´-uh-to-hi-uh-lin)—A **precursor** for keratin

Precursor (pre´-kuhr-suhr)—A substance from which another substance is formed; a condition that leads to another condition

4. **Stratum spinosum**—The keratin-synthesizing inner layer of the epidermis characterized by pronounced **desmosomes** that give the appearance of spikes running between the cells (see Figure 2 on page 15)

✔ **NOTE:** The stratum spinosum is sometimes called the *spiny layer* or the *prickly layer*, and it may consist of eight to ten sublayers. RNA within the cells of this layer begins the synthesis of keratin.

KEY TERMS

Spinosum (spi-no´-suhm)—The Latin term for "spiny"

Desmosome (dez´-muh-som)—A small, circular, dense area within the intercellular bridge that forms the site of adhesion between certain epithelial cells, especially of the epidermis

5. **Stratum germinativum**—The innermost layer of the epidermis where columnar cells continually undergo mitosis to make new cells and push older cells outward (see Figure 2 on page 15)

✔ **NOTE:** Some authorities use the term *stratum germinativum* to apply to both the stratum spinosum and the germination layer, which is then referred to as the *stratum basale* (see Figure 2 on page 15).

KEY TERMS

Germinativum (jer´-muh-nat-iv-uhm)—The Latin term for "germination"

✔ **NOTE:** Germination is the process of seeds developing and growing. The term *germinativum* is a reference to the fact that cells are continually developing in this layer to provide cells for the outer layers of the epidermis.

Basale (ba´-suhl)—The Latin term for "base layer"

OBJECTIVE 7 **Distinguish between descriptions of the layers of the dermis.**

1. **Papillary** (pap´-uh-ler-e) **layer**—The outer layer of the dermis that lies next to the basal layer of the epidermis and is patterned with papillae and hollows

✔ **NOTE:** The papillary layer produces the external ridges of the skin that are evident in fingerprints and other skin patterns.

KEY TERM

Papilla (puh-pil´-uh)—A protrusion that extends into the epidermal area (see Figure 2 on page 15)

2. **Reticular** (ri-tik´-yuh-luhr) **layer**—The inner layer of the dermis that forms a network of interlacing cells and fibers, making this layer tough and elastic (see Figure 2 on page 15)

✔ **NOTE:** The reticular layer has fibers of collagen that make the layer tough. Collagen fibers are also elastic, allowing the skin to stretch and return to its original shape. Numerous muscles, such as those in the face and scalp, attach to the reticular layer.

OBJECTIVE 8

Define the term *auxiliary appendage*.

- **Auxiliary appendage**—A formation of specialized cells within the skin that performs a particular function

  Examples: Hair, nails, sebaceous glands, sweat glands, ceruminous glands, nerve endings

✔ **NOTE:** You will study the various auxiliary appendages in Objective 9 through Objective 12.

OBJECTIVE 9

Complete statements that describe the characteristics of hair.

1. **Hair grows from a follicle in the skin; at the base of the follicle is a bundle of stratum germinativum cells known as the *germinal matrix*; a dermal papilla joins the germinal matrix with capillaries that support the mitosis of the germinal-matrix cells** (see Figure 2 on page 15).

2. **Arrector pili muscles are attached to the follicles** (see Figure 2 on page 15).

KEY TERMS

Follicle (fawl´-i-kuhl)—A tube that extends from the dermis through the epidermis and to the surface of the skin

Arrector pili (uh-rek´-tor pe´-li) **muscle**—Bundles of involuntary muscle fiber that contract against the follicle when the skin is cold or during certain emotional states, causing the hair shaft to stand upright; also called *pilomotor muscle*

✔ **NOTE:** In humans, the reaction of the arrector pili muscles results in goose-bumps or gooseflesh.

3. **A hair consists of a part that protrudes from the skin—called the *shaft*—and a subdermal section—called the *root*** (see Figure 2 on page 15).

4. **Hair color results from pigment within the shaft.**

5. **Hair is kept soft by sebum that is secreted by two or more sebaceous glands** (see Figure 2 on page 15).

KEY TERMS

Sebum (seb´-uhm)—The oily secretion of the sebaceous glands of the skin; composed of keratin, fat, and cellular debris

✔ **NOTE:** Combined with sweat, sebum forms a moist, oily, acidic film that is mildly antibacterial and antifungal and protects the skin and hair against drying. Because the shaft of a hair is exposed to the air outside the body, the hair would dry out and break off without the moisture provided by the sebum.

Sebaceous (si-ba´-shuhs) **gland**—The gland that is connected to the dermal shaft that surrounds the root of a hair

6. **Hair is found on all outer parts of the body except the penis and the contact areas of the hands and feet.**
7. **Hair on humans has little practical function except for the eyelashes, nasal hairs, and hair on the ears, all of which provide some level of protection against dust and foreign matter.**
8. **Hair grows approximately ½ inch (13 millimeters) per month.**

OBJECTIVE 10

Complete statements that describe the characteristics of nails (see Figure 3 on page 16).

1. **Nails consist of epidermal cells that have been converted to keratin.**
2. **Nails grow from epithelial cells lying under the lunula at the proximal end of a nail.**
3. **The region under a nail is called the *subungual*** (suhb-ung´-gwuhl) ***area* (*nail bed*).**
4. **The skin surrounding a nail is called the *cuticle*.**

KEY TERMS

Lunula (loon´-yuh-luh)—The Latin term meaning "little moon"; the cresecent-shaped white area at the base of a nail

Cuticle (kyut´-i-kuhl)—The thin edge of cornified epithelium at the base of a nail

OBJECTIVE 11

State the functions of the glands located in the skin.

1. **Sebaceous glands** (see Figure 2 on page 15)
   - Secrete sebum to lubricate and soften hair shafts
   - Prevent excessive water evaporation and water absorption through the skin

- Lessen the amount of heat lost through the skin

2. **Sweat glands** (see Figure 2 on the next page)

KEY TERM

Sweat (swet´) **gland** —A small structure located in the deep layers of the dermis with a duct that exits through a pore (see Figure 2 on the next page) in the epidermis; the gland consists of a coiled tube surrounded by capillaries

✔ **NOTE:** Sweat glands are especially numerous on the palms, soles, and axillae (ak-sil´-e) (armpits). A square inch of skin on the palms contains approximately 3000 sweat glands. Sweat glands are classed as eccrine (ek´-ruhn) or apocrine (ap´-uh-kruhn). Eccrine sweat glands are by far the most numerous and originate in the subcutaneous tissue. Apocrine glands originate in the dermis and are concentrated in the axillae, nipples, and anus.

- Help to maintain homeostasis of fluids and electrolytes and body temperature
- Excrete nitrogenous wastes

3. **Ceruminous glands**—Secrete cerumen

✔ **NOTE:** Ceruminous glands are modified sweat glands located in the external ear canal. They are simple coiled tubes, sometimes associated with hair follicles in the external ear. Cerumen helps to keep the external ear from dehydrating.

OBJECTIVE 12 **List the types of nerve endings found in the skin.**

✔ **NOTE:** The structure and functions of the cutaneous nerve endings are discussed in more detail in Module 4, "Nervous System," and Module 6, "Special Senses," in this module set. Figure 2 on the next page shows the location of a nerve in the integument.

1. **Touch**
2. **Pressure**
3. **Heat**
4. **Cold**
5. **Pain**

OBJECTIVE 13 **Label the major structures of the integument** (see Figure 2 below and Figure 3 on the next page).

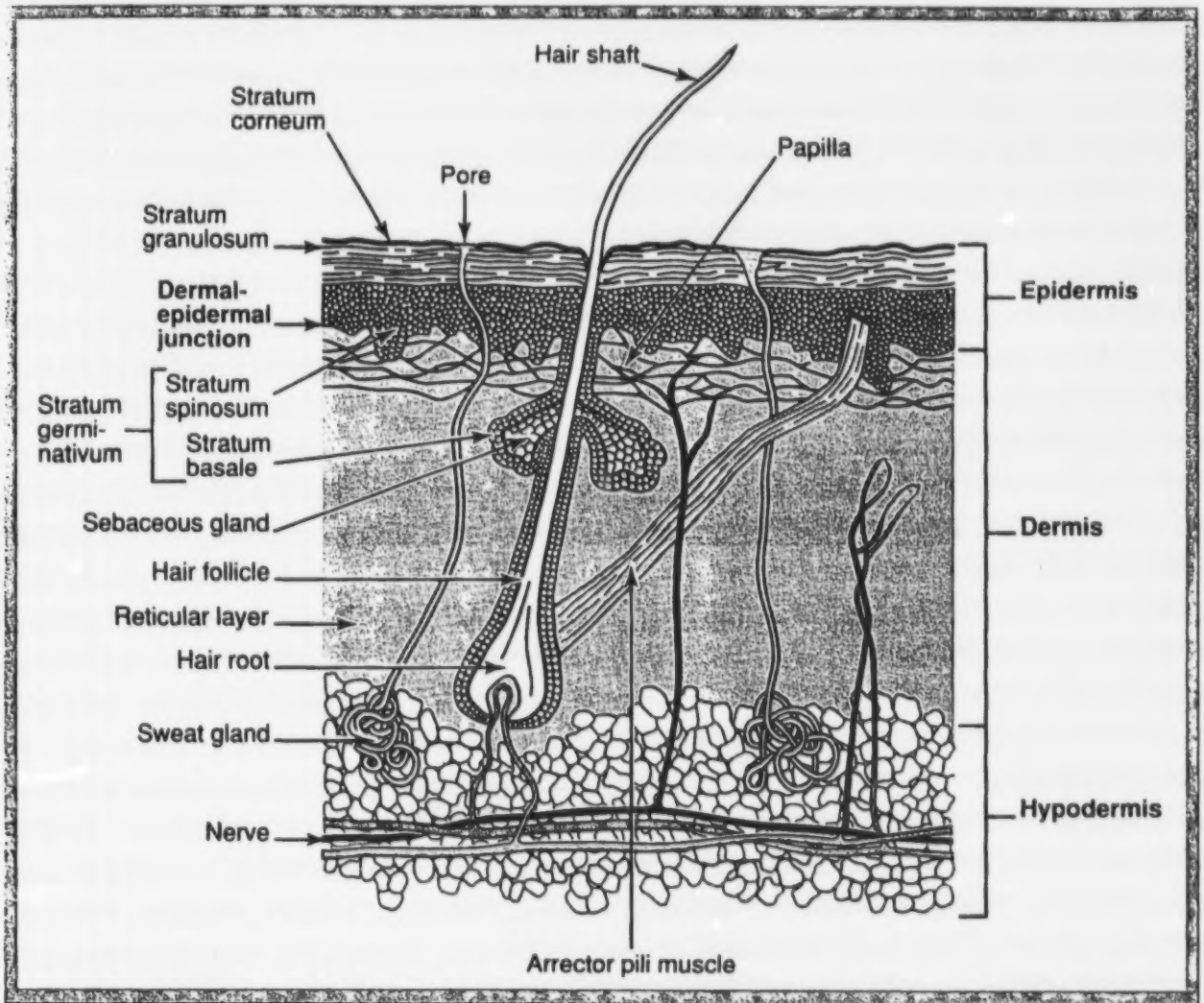


Figure 2.
Major structures of the integument.

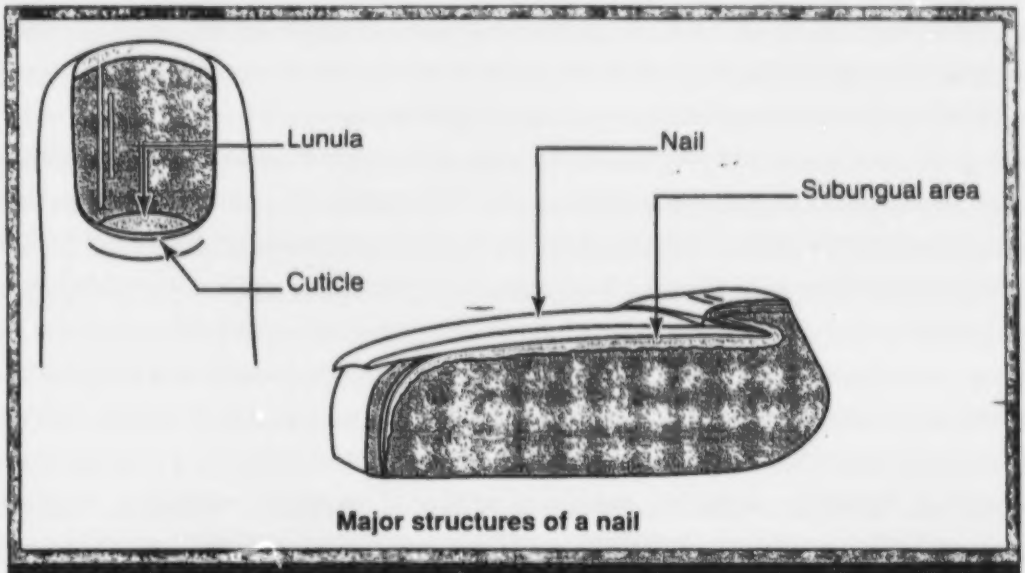


Figure 3
Major structures of the integument (continued)

OBJECTIVE 14

Match common disorders and abnormalities of the integument to their correct definitions.

1. **Acne** (ak´-ne)—An infection and inflammation of the sebaceous glands

   ✔ **NOTE:** Acne is evidenced by the pustules commonly referred to as *pimples.*

2. **Hive** (hiv´)—A suddenly appearing raised patch that is usually redder than the surrounding skin; is often accompanied by severe itching; and is usually caused by an allergic reaction, infection, or stress

   ✔ **NOTE:** The term *urticaria* (uhrt-uh-kar´-e-uh) is also used to describe hives.

3. **Decubitus ulcer** (di-kyu´-bi-tuhs uhl´-suhr)—A pressure sore that is frequently found on the **sacrum**, elbows, and heels

   ✔ **NOTE:** These pressure sores—commonly referred to as *bedsores*—often appear on patients who are confined to bed for a long period.

KEY TERM

Sacrum (sak´-ruhm)—The large, triangular bone at the dorsal part of the pelvis, inserted like a wedge between the two hip bones

4. **Furuncle** (fyur´-uhn-kuhl)—An inflammation and infection of the dermis and subcutaneous tissue caused by bacteria that enter the skin through a hair follicle; a boil

5. **Vesicle** (ves´-i-kuhl)—A blister

6. **Nodule** (nawj´-uhl)—A small, solid, irregularly shaped cluster of cells

7. **Polyp** (pawl´-uhp)—A growth that extends into the **lumen** of a mucous membrane or appears on the skin

8. **Pustule** (puhs´-t{y}uhl)—An elevation of skin filled with **pus**

KEY TERMS

Lumen (lu´-muhn)—A cavity, especially in a tubular organ or structure

Pus (pus´)—An accumulation of white blood cells, pathogens, dead or damaged cells, and other substances associated with an infection

9. **Cyst** (sist´)—A sac that contains any fluid substance other than pus

10. **Fissure** (fish´-uhr)—A cleft or groove in the skin or tissue

11. **Ulcer** (uhl´-suhr)—A loss of substance on a cutaneous or mucous surface

12. **Paronychia** (per-uh-nik´-e-uh)—An infection of the fold of skin at the margin of a nail

13. **Onycholysis** (awn-i-kol´-i-sis)—A condition of the nail separating from the nail bed, usually caused by stress to long nails

OBJECTIVE 15

Assignment Sheet 1—Practice Critical Thinking: Investigate Skin Cancer

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

Worldwide, skin cancers are one of the most rapidly increasing forms of cancer. Various researchers have suggested several reasons for this. Some investigators have suggested that, at the present rate, by 2010 as many as one in five persons in the United States will experience skin cancer.

In this assignment sheet, you will have an opportunity to study skin cancers and draw some conclusions about these trends. Using resources within your facility and elsewhere as directed by your instructor, you will complete an investigative report on skin cancer. You will be asked to draw conclusions based on the information you obtain from the resources used.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Read the investigation points on the next page. Your investigative report must include answers to all three of these investigation points.

_____ 3. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided on the next page.

_____ 4. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 5. Complete your investigation and give your investigative report to your instructor for evaluation.

Format of investigative report _____

_____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

_____

INVESTIGATION POINT 1

Skin cancer generally originates in the epidermis. The appearance of a cancer on a limited area of skin is not life threatening and can generally be resolved by surgery. Are there exceptions to this generalization? Provide information about whether it is possible to have malignant skin cancer and, if so, about the threat the cancer poses.

INVESTIGATION POINT 2

Skin cancers are becoming more common. For example, in the past 20 years, the rate of melanoma has increased by 4 to 5 percent annually. Significantly, the highest per capita rate—that is, the rate per person in a population—of melanoma and some other skin cancers is in Australia. What factors contribute to these trends and why would Australia be particularly hard hit?

INVESTIGATION POINT 3

Skin cancers often arise from nevi or moles and similar pigmented structures on the skin. When examining a nevus to determine if it might be cancerous, medical professionals often refer to the ABCDs of mole appearance. What do these letters stand for and what is the significance of each characteristic?

1030

OBJECTIVE 16

Assignment Sheet 2—Practice Critical Thinking: Investigate Burns

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

The skin can be affected by several types of energies that cause the tissue damage commonly referred to as *burns*. Burns can occur from exposure to heat, such as fire or scalding liquids; electrical currents; ultraviolet radiation; nuclear radiation; and other energy sources. Severe burns will generally require surgery to remove damaged tissue and to repair the trauma to the extent possible, including the use of skin grafts and plastic surgery. In this assignment sheet, you will study medical perspectives of burns.

Using resources within your facility and elsewhere as directed by your instructor, you will complete an investigative report on burns. You will be asked to draw conclusions based on the information you obtain from the resources used.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Read the investigation points on the next page. Your investigative report must include answers to both of these investigation points.

_____ 3. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided on the next page.

_____ 4. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 5. Complete your investigation and give your investigative report to your instructor for evaluation.

Format of investigative report _____

Evaluation criteria _____

INVESTIGATION POINT 1

Burns are generally classed as first-, second-, and third-degree. Describe each class of burn and the treatment commonly given for each class.

INVESTIGATION POINT 2

One of the important care-assessment considerations in the event of burns is to determine how much of the body is involved in each class of burn. Health-care facilities use various types of assessment scales, such as the "Rule of Palms," "Rule of Nines," and Lund-Browder charts. Determine the type of assessment scale used in your facility and then provide estimates of the body areas involved in the two case studies illustrated on the next page. Figure 1 shows burns on a 43-year-old male and Figure 2 shows burns on a 4-year-old female.

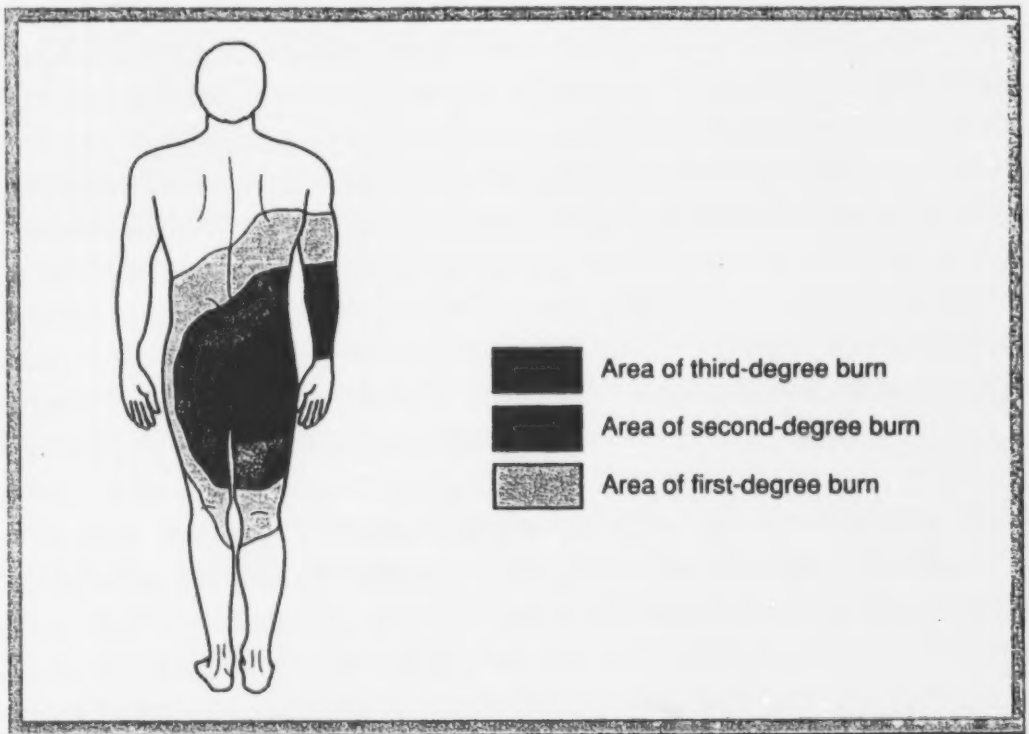


Figure 1
43-year-old male burn victim

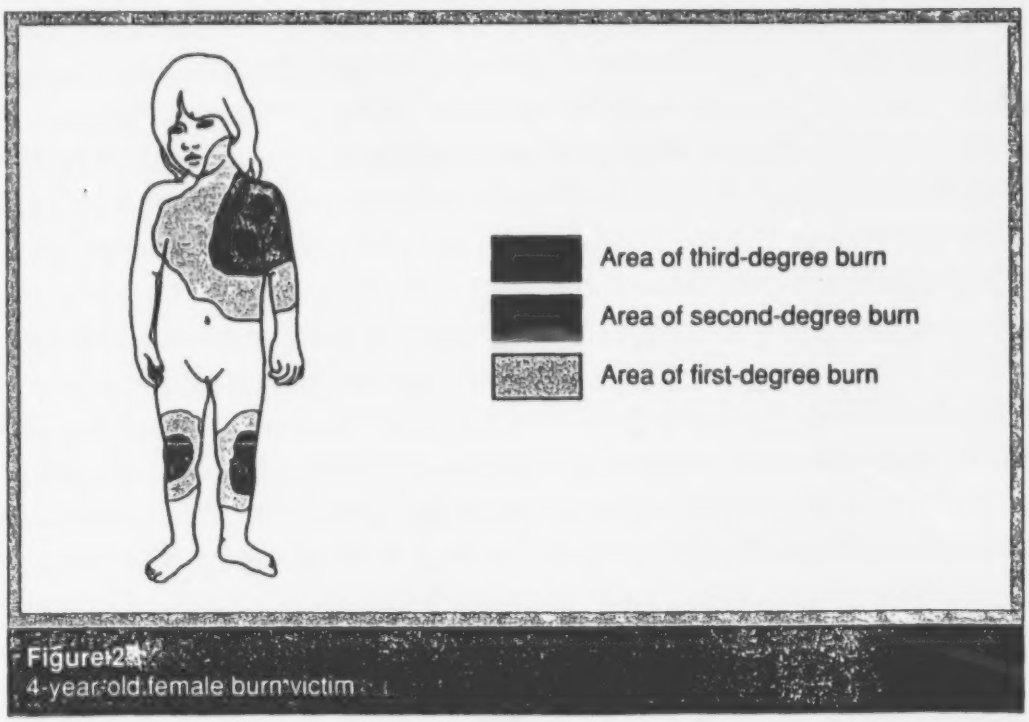


Figure 2
4-year-old female burn victim

MODULE SET II:
Major Body Systems

Module-2: Skeletal System

1034

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheets	
1—Classify Bone Fractures	37
2—Practice Critical Thinking: Research the Current Medical Understanding of the Causes and Treatments of Rheumatoid Arthritis	43

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 27.
- ❑ 5. **Research** Online resources to learn more about the skeletal system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Classify Bone Fractures."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Do** Assignment Sheet 2, "Practice Critical Thinking: Research the Current Understanding of the Causes and Treatments of Rheumatoid Arthritis."
- ❑ 11. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 12. If the evaluation is not satisfactory, repeat step 10.

❑ 12.	**Check**	With your instructor for any additional assignments to be completed.
❑ 13.	**Do**	Additional assignments your instructor lists below.
❑ 14.	**Take**	Module Review provided by your instructor.
❑ 15.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 16.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheets, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

_____

_____

_____

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to define and identify the major divisions and bones of the skeletal system, state the characteristics of bone and cartilage, and describe the components of the articular system. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *skeletal system*.
2. State the functions of the skeletal system.
3. Distinguish between phrases that describe the characteristics of bone and cartilage.
4. List the major components of bones.
5. Complete statements that describe the types of bones as classified by their location and structure.
6. State the characteristics of bone marrow.
7. Define the major structures of a long bone.
8. Label the major structures of a long bone.
9. Match the long bones of the skeleton to their correct definitions.
10. Define terms that describe the cavities and processes of bones.
11. Describe the major divisions of the human skeleton.
12. Label the major components of the anterior and posterior axial skeleton.
13. Label the major bones of the anterior and posterior appendicular skeleton.
14. Define the major bones and structures of the cranium, face, and ear.
15. Label the major bones and structures of the cranium, face, and ear.
16. State the characteristics of the hyoid bone.
17. Define the regions and the major bones and structures of the vertebral column.
18. Label the regions and the major bones and structures of the vertebral column.
19. Complete statements that describe the characteristics of the ribs and sternum.
20. Label the major bones and structures of the ribs and sternum.

21. Define the term *articular system*.
22. State the functions of the articular system.
23. Complete statements that describe the major structures and substances of the articular system.
24. Distinguish among phrases that describe the types of articulations.
25. Describe types of amphiathrosis articulations.
26. Match types of diathrosis articulations to their correct descriptions.
27. Match common disorders and abnormalities of the skeletal system to their correct definitions.
28. Classify bone fractures. (Assignment Sheet 1)
29. Practice critical thinking: research the current medical understanding of the causes and treatments of rheumatoid arthritis. (Assignment Sheet 2)

Information Sheet

OBJECTIVE 1

Define the term *skeletal system*.

- **Skeletal system**—All of the bones and cartilage of the body that collectively provide the supporting framework for the muscles and organs (see Figure 1)

✔ **NOTE:** See Objective 3 for descriptions of the terms *bone* and *cartilage*.

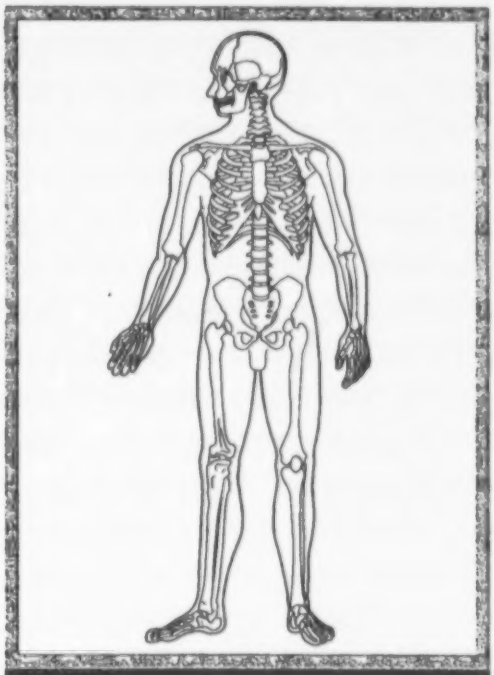


Figure 1
Skeletal system

OBJECTIVE 2

State the functions of the skeletal system.

1. **Provides support for the body**

✔ **NOTE:** The skeletal system—also called the *skeleton*—is a framework of bones that are connected to each other by joints and by connective tissue called *ligaments* (li´-guh-muhnts). The ligaments also attach muscles to many of the body's bones. In this way, the body is built upon the skeletal system. Consequently, the shape of the body also follows the structure of the skeleton.

2. **Gives shape to the body**

3. **Protects delicate vital organs**

✔ **NOTE:** The very term *vital* indicates that an organ is necessary for a healthy life. Most internal organs are made of soft tissues, with cells that promote the exchange of materials in order to perform their functions. Thus, they must support the pathways that allow these materials to move among them, which generally means that their surfaces are exposed to other organs and systems and that they are joined by flexible ducts and vessels capable of bending with body movements. Most of the protection for these organs is provided by bones and overlying muscles. For example, the ribs protect the lungs, heart, spleen, and liver. The genitourinary organs and intestines are largely protected by the hips and pelvis.

4. **Assists with body movements**

✔ **NOTE:** Most body movements are the result of muscles pulling and pushing against skeletal structures. The bones not only provide tension points for the muscles, they also limit the range of motion (ROM) of the movement so that balance and strength are possible.

5. **Manufactures blood cells**

6. **Stores calcium and phosphorus**

OBJECTIVE 3 **Distinguish between phrases that describe the characteristics of bone and cartilage.**

1. **Bone**

- Is firm and hard in structure
- Consists of **osteocytes**
- Includes a **matrix** of calcium salts and collagen

KEY TERMS

Osteocyte (os´-te-uh-sit)—The basic bone cell

✔ **NOTE:** In some bones the osteocytes are arranged in rings that form haversian (huh-vuhr´-zhuhn) canals. Blood vessels run through the haversian canals and exchange nutrients, wastes, oxygen, and carbon dioxide with the surrounding osteocytes through narrow channels referred to as *canaliculi* (ka-nuh-li´-kyuh-li).

Matrix (ma´-triks)—The intercellular substance in tissue

✔ **NOTE:** All tissues have some sort of substance between the cells of which they consist. These matrices can vary greatly from one to another. The matrix within bone is somewhat rigid with a definite structure, while the matrix of blood—plasma—is liquid and constantly moving. The matrix of bone consists primarily of the protein collagen and the compounds calcium carbonate and calcium phosphate. These salts provide a place for storing calcium and phosphorus.

- Has a system of haversian canals and canaliculi that ensures a good supply of blood and pathways for the movement of substances within the matrix

2. **Cartilage**

- Is firm, yet flexible

✔ **NOTE:** Cartilage is primarily found in two types of structures. First, it is present on the surface of many bones, especially at bone joints. Because the cartilage cells are particularly smooth, they reduce friction between bones in contact with each other. The fact that cartilage is flexible makes it well suited for its other major function of supporting soft structures, such as the nose, external ears, and trachea.

- Consists of **chondrocytes**

✔ **NOTE:** In the fetus, the entire skeletal system consists of cartilaginous (kawr-tuh-la´-juh-nuhs) tissues. Through a process called *ossification* (aw-suh-fuh-ka´-shuhn), most of the cartilage is converted into bone during the first couple of years of life. In bones that have cartilage surfaces, there is generally an area of cartilage in which production of chondrocytes continues after most of the bone has ossified, causing the bone to lengthen until the individual is fully grown.

KEY TERM

Chondrocyte (kon´-druh-sit)—One of the cells that forms cartilage

- Includes a matrix of protein
- Has no capillaries in the matrix so blood is supplied by diffusion

OBJECTIVE 4 **List the major components of bones.**

1. **Inorganic salts**
2. **Bone cells**
3. **Blood vessels**
4. **Nerves**
5. **Cartilage**
6. **Water**

OBJECTIVE 5

Complete statements that describe the types of bones as classified by their location and structure.

Five basic types of bones are described below. While these bones are essentially classified by their shape (long, short, flat, irregular, and sesamoid), their shapes serve specific functions and support the purpose of the body structure that houses each type of bone. This objective describes the five types of bones by their shape, their location in the body, and their structure.

1. **Long bones**

   - Found in the arms, legs, hands, and feet

     ✔ **NOTE:** You will study the long bones of the skeleton in Objective 9.

   - Consist of a long shaft called a *diaphysis* (di-a´-fuh-suhs) and two rounded ends, each called an *epiphysis* (i-pi´-fuh-suhs) (see Figure 2 on page 14)

     ✔ **NOTE:** The diaphysis is the long, narrow portion of the bone. At each end, the diaphysis increases in diameter to form a round epiphysis. The epiphyses provide the articulating surfaces—the part of the long bone that forms a joint with the connecting bone. At the junction of the diaphysis and each epiphysis is a structure called the *epiphyseal* (i-pi-fuh-se´-uhl) *plate*. Growth takes place in the epiphyseal plate as cartilage is produced on the epiphysis side and **osteoblasts** are converted to bone matrix on the diaphysis side. You will study more about the structure of long bones in Objective 7 through Objective 9.

KEY TERM

Osteoblast (aws´-te-uh-blast)—A specialized osteocyte that forms the wall of the marrow cavity

✔ **NOTE:** Osteoblasts form the inner lining of long bones around the marrow or medullary (me´-duhl-er-e) cavity (see Figure 2 on page 14). Osteoblasts are also important in that they mend the tissue of broken bones.

   - Contain yellow bone marrow in the shaft (diaphysis)

     ✔ **NOTE:** There are two types of marrow—yellow and red. As the embryonic cartilage takes the shape of the bones that it will become, it develops red marrow. Red marrow produces blood cells, including red and white cells and platelets. After birth, much of the red marrow is converted into osteocytes that are primarily adipose tissue, giving the marrow its characteristic yellow color. Marrow in the long bones of adults is almost entirely yellow marrow, though red marrow remains in many of the other types of bones. You will study more about bone marrow in Objective 6.

   - Contain spongy bone covered with compact bone in the epiphyses

     ✔ **NOTE:** There are two types of tissue structures in bone. One type is a network of fibers with voids between them and is referred to as *cancellous* (kan-

se´-luhs) *tissue* (see Figure 2 on page 14) or as *spongy bone tissue*. The second type of bone tissue consists of densely packed osteocytes and is referred to as *compact bone tissue* (see Figure 2 on page 14). You will study more about these structures in Objective 7 and Objective 8.

2. **Short bones**

   - Include the **carpals** and **tarsals**

KEY TERMS

Carpals (kar´-puhls)—The wrist bones (see Figure 15 on page 21)

Tarsals (tar´-suhls)—The ankle bones that form the heel and the proximal or posterior half of the foot (see Figure 15 on page 21)

✔ **NOTE:** The bones of the wrist and ankles are short and are generally rectangular or triangular bones that fit together to provide a segmented structure that is highly flexible yet strong.

   - Made of spongy bone covered with compact bone
   - Contain red bone marrow in the spongy bone

3. **Flat bones**

   - Include the **ribs**, **scapulae**, **ilium**, and **cranial bones**

KEY TERMS

Rib—Any of the paired, curved, bony, or partly cartilaginous rods that stiffen the walls of the body (see Figure 14 on page 20)

✔ **NOTE:** You will study more about the ribs in Objective 19 and Objective 20.

Scapula (skap´-yuh-luh)—A shoulder blade (see Figure 15 on page 21)

Ilium (il´e-uhm)—The flat portion of the hip (see Figure 15 on page 21)

Cranial (kra´-ne-uhl) **bones**—The bones of the skull, particularly the bones that enclose the brain (see Figure 16 on page 24)

✔ **NOTE:** You will study more about the cranial bones in Objective 14 and Objective 15.

   - Made of spongy bone covered with compact bone
   - Contain red bone marrow in the spongy bone

4. **Irregular bones**
   - Include the **vertebrae** and facial bones

     ✔ **NOTE:** You will study the bones of the face in Objective 14 and Objective 15.

KEY TERM

Vertebra (vuhr´-tuh-bruh)—One of the bony or cartilaginous segments composing the spinal column (see Figure 19 on page 28)

✔ **NOTE:** You will study more about the vertebrae in Objective 17 and Objective 18.

   - Made of spongy bone covered with compact bone
   - Contain red bone marrow in the spongy bone

5. **Sesamoids**
   - Include the **patella** and small bones in the hands and feet

KEY TERMS

Sesamoid (ses´-uh-moid)—Any one of numerous small, round, bony masses embedded in certain tendons that may be subjected to compression and tension

✔ **NOTE:** The term *sesamoid* literally means "resembling a sesame seed."

Patella (puh-te´-luh)—The kneecap (see Figure 15 on page 21)

✔ **NOTE:** The patella is the largest sesamoid bone in the skeleton.

   - Often develop in new locations due to the use of tendons
   - Consist of cartilage that ossifies with age

OBJECTIVE 6 **State the characteristics of bone marrow.**

1. **Is a soft, sponge-like material found in the cavities of bones**
2. **Is a network of blood vessels and special connective tissue that holds together fat and blood-producing cells**
3. **Is red in the diploe, ribs, sternum, vertebral bones, and proximal epiphysis of the humeri and femurs**

   ✔ **NOTE:** You will study the humerus (hyu´-muh-ruhs) and the femur (fe´-muhr) in Objective 9.

KEY TERM

Diploe (di´-pluh-we)—The layer of spongy bone tissue within the plates of the skull

4. **Is yellow in most other bones, consisting primarily of fatty tissues**

OBJECTIVE 7

Define the major structures of a long bone (see Figure 2 on the next page).

1. **Epiphysis** (i-pi´-fuh-suhs)—The part or process of a bone that ossifies separately and later becomes **ankylosed** to the main part of the bone; one of the ends of a long bone

KEY TERM

Ankylosis (an-ki-lo´-suhs)—The union of separate bones or hard parts to form a single bone or part

2. **Diaphysis** (di-a´-fuh-suhs)—The shaft of a long bone
3. **Cancellous** (kan-se´-luhs) **bone**—The porous bone tissue that is normally present in the interior of many bones where the spaces are usually filled with marrow
4. **Compact bone**—The hard, dense tissue that is usually found at the surface of a bone
5. **Medullary** (me´-duhl-er-e) **cavity**—The cavity that contains the bone marrow
6. **Periosteum** (per-e-as´-te-uhm)—The fibrous vascular membrane covering a bone, except at the extremities
7. **Endosteum** (en-das´-te-uhm)—The layer of vascular connective tissue lining the medullary cavity of a bone
8. **Epiphyseal** (i-pi-fuh-se´-uhl) **cartilage**—A thin layer of cartilage between the epiphysis and the diaphysis

✔ **NOTE:** This bone structure may also be called the *epiphyseal plate*. The epiphysis is a secondary bone-forming center of the bone, and the new bone forms along the plate.

OBJECTIVE 8 **Label the major structures of a long bone** (see Figure 2).

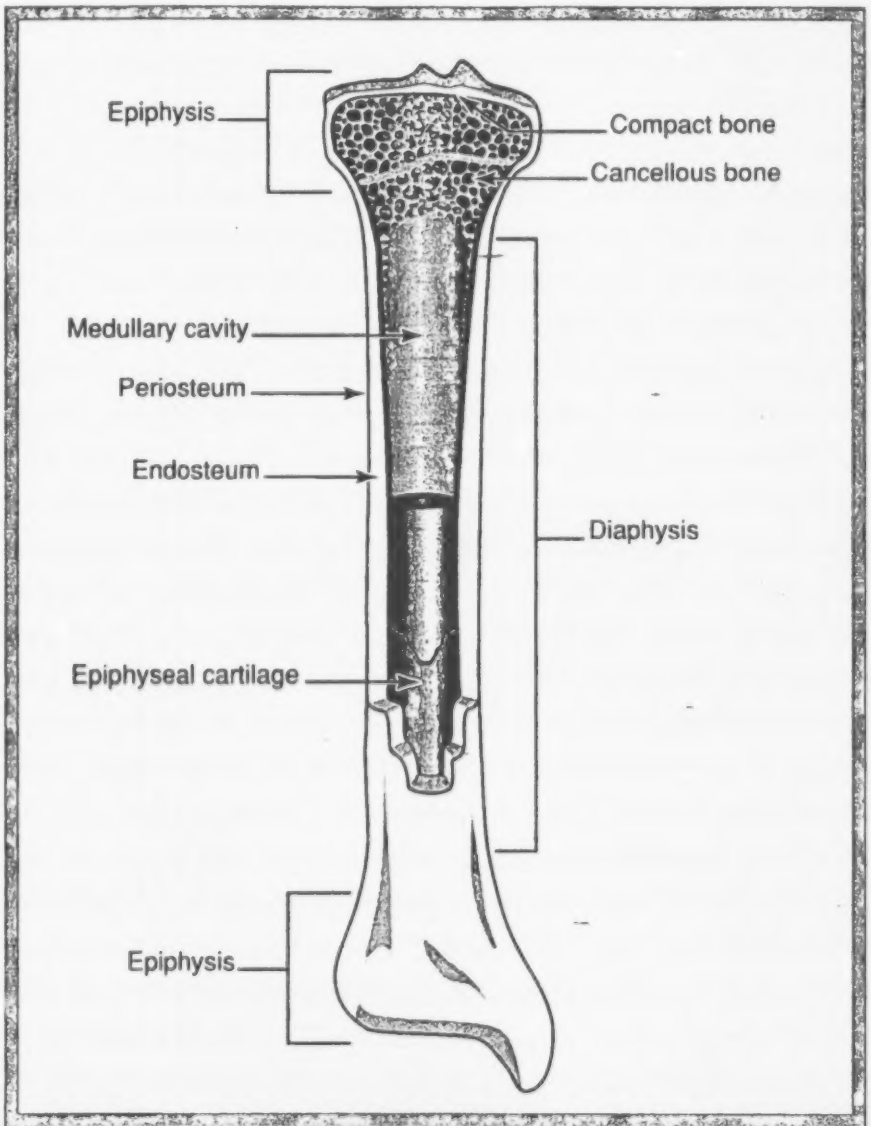


Figure 2.
Major structures of a long bone

OBJECTIVE 9 **Match the long bones of the skeleton to their correct definitions** (see Figure 15 on page 21).

1. **Humerus** (hyu´-muh-ruhs)—The long bone in the upper arm
2. **Radius** (ra´-de-uhs)—The long bone on the thumb side of the forearm

3. **Ulna** (uhl´-nuh)—The long bone on the little-finger side of the forearm

   ✔ **NOTE:** The ulna is longer than the radius.

4. **Femur** (fe´-muhr)—The thighbone; the longest, strongest bone in the body

5. **Fibula** (fi´-byuh-luh)—The long, slender bone on the lateral side of the lower leg

6. **Tibia** (ti´-be-uh)—The shin bone; the largest bone in the lower leg

7. **Metacarpals** (me-tuh-kar´-puhls)—The long bones forming the framework of the palm of the hand

8. **Phalanges** (fuh´-lan-jes)—The miniature long bones of the fingers and the miniature long bones of the toes

   ✔ **NOTE:** There are three phalanges in each finger and two in each thumb. There are two phalanges in each great toe and three in each of the other toes.

9. **Metatarsals** (me-tuh-tar´-suhls)—The long bones that form the framework of the sole of the foot

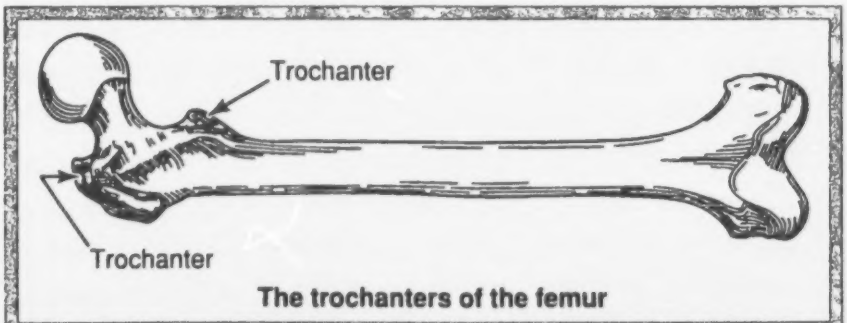
OBJECTIVE 10 **Define terms that describe the cavities and processes of bones.**

KEY TERM
Process (pro´-suhs)—A projection of a bone

✔ **NOTE:** As you learned in Objective 5, bones are classified by their shapes and these shapes are related to body structure and the purpose of a particular bone. Often the basic structure of a bone includes a process or a cavity. These special structures may fit into other bones, provide a point of connection for muscle, or support some other function of the bone.

1. **Trochanter** (tro-kan´-tuhr)—A very large process to which muscles attach (see Figure 3)

   Example: The trochanters of the femur



The trochanters of the femur

Figure 3: Trochanters

2. **Crest**—A ridge on a bone (see Figure 4)

   Example: The crest of the ilium

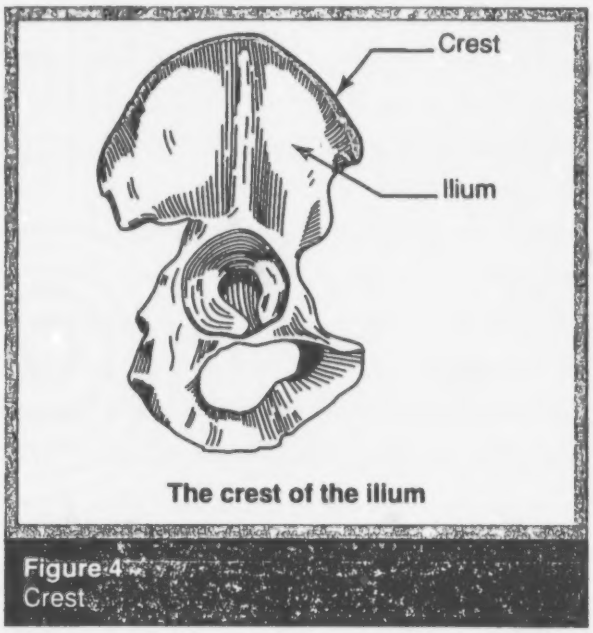


Figure 4
Crest

3. **Spinous** (spi´-nuhs) **process**—A sharp projection on a bone (see Figure 5)

   Example: The spinous process of a vertebra

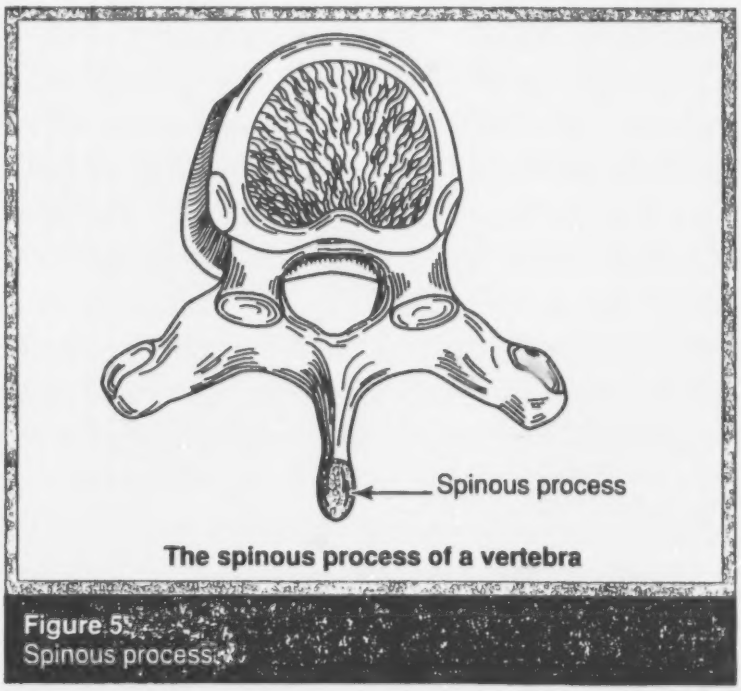


Figure 5
Spinous process

4. **Tuberosity** (tu-buh-ra´-suh-te)—A large rounded projection on a bone (see Figure 6)

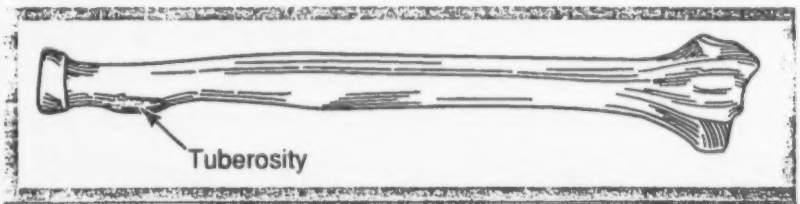


Figure 6
Tuberosity

5. **Tubercle** (tu´-buhr-kuhl)—A small rounded projection on a bone (see Figure 7)

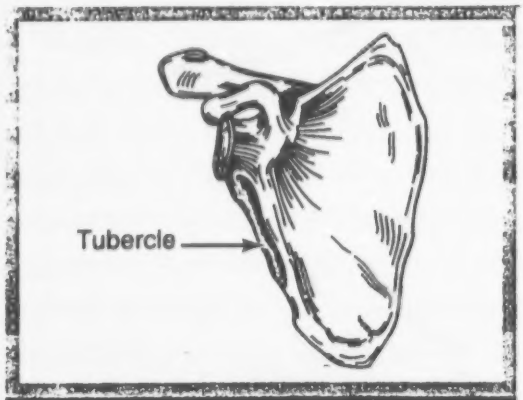


Figure 7
Tubercle

6. **Condyle** (kon´-dil)—A rounded process that generally mates with another to form a joint (see Figure 8)

Example: The knee joint is formed where the condyle of the femur meets the condyle of the tibia.

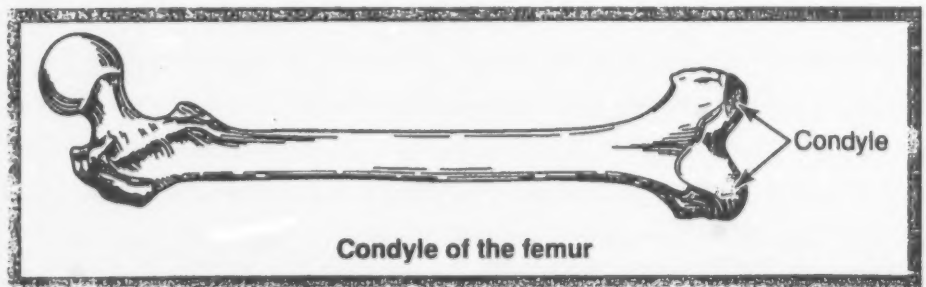


Figure 8
Condyle

7. **Head**—A process that forms a joint at the end of a narrowed structure called a *neck* (see Figure 9)

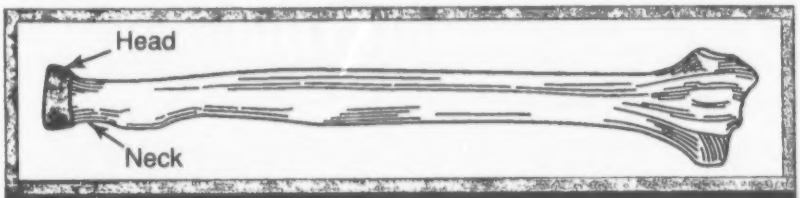


Figure 9
Head

8. **Fossa** (faw´-suh)—A depression or hollow area in a bone (see Figure 10)

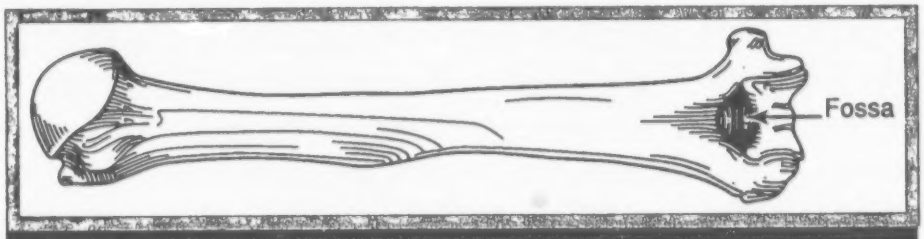


Figure 10
Fossa

9. **Sinus** (si´-nuhs)—A cavity in bone that is lined with mucous membrane (see Figure 11)

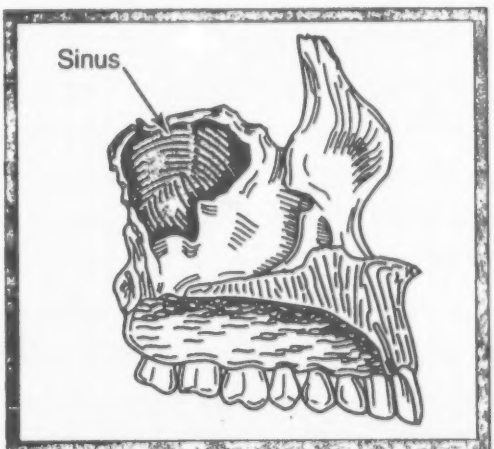


Figure 11
Sinus

10. **Foramen** (fuh-ra´-muhn)—A hole in a bone (see Figure 12)

    Examples: The spinal cord extends from the brain and into the spinal column through the foramen magnum, and the nerves that support the sense of smell pass through holes called the *olfactory foramina* (the plural of foramen).

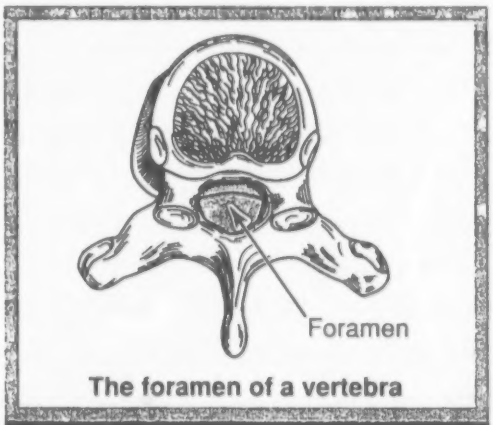


Figure 12.
Foramen.

11. **Meatus** (me-a´-tuhs)—A tubular opening or passage in a bone (see Figure 13)

    Example: The passage that allows sound to reach the inner ear is called the *external auditory meatus.*

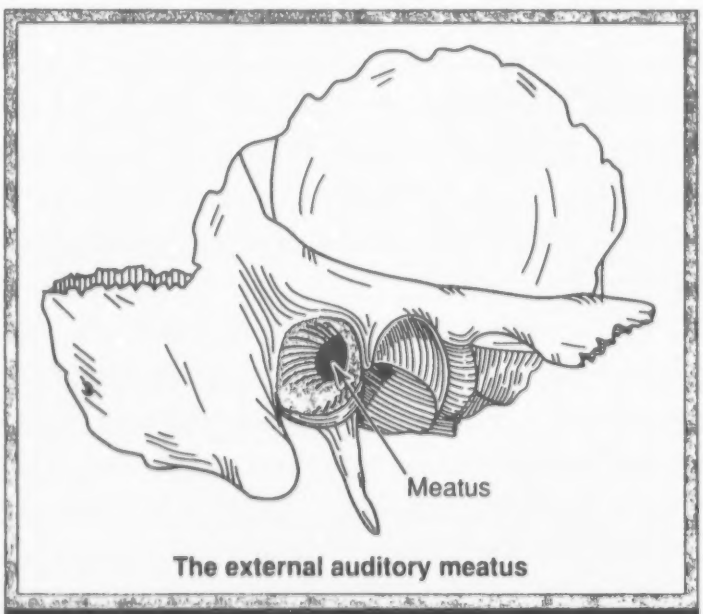


Figure 13.
Meatus.

OBJECTIVE 11

Describe the major divisions of the human skeleton.

1. **Axial skeleton**—Centers around the vertebral column and includes the bones of the skull, the ribs and sternum, and the vertebral column; contains 80 bones (see Figure 14 below)

2. **Appendicular skeleton**—Consists of the bones of the appendages that are attached to the axial skeleton and includes the bones of the shoulders, pelvis, arms, and legs; contains 126 bones (see Figure 15 on the next page)

OBJECTIVE 12

Label the major components of the anterior and posterior axial skeleton (see Figure 14).

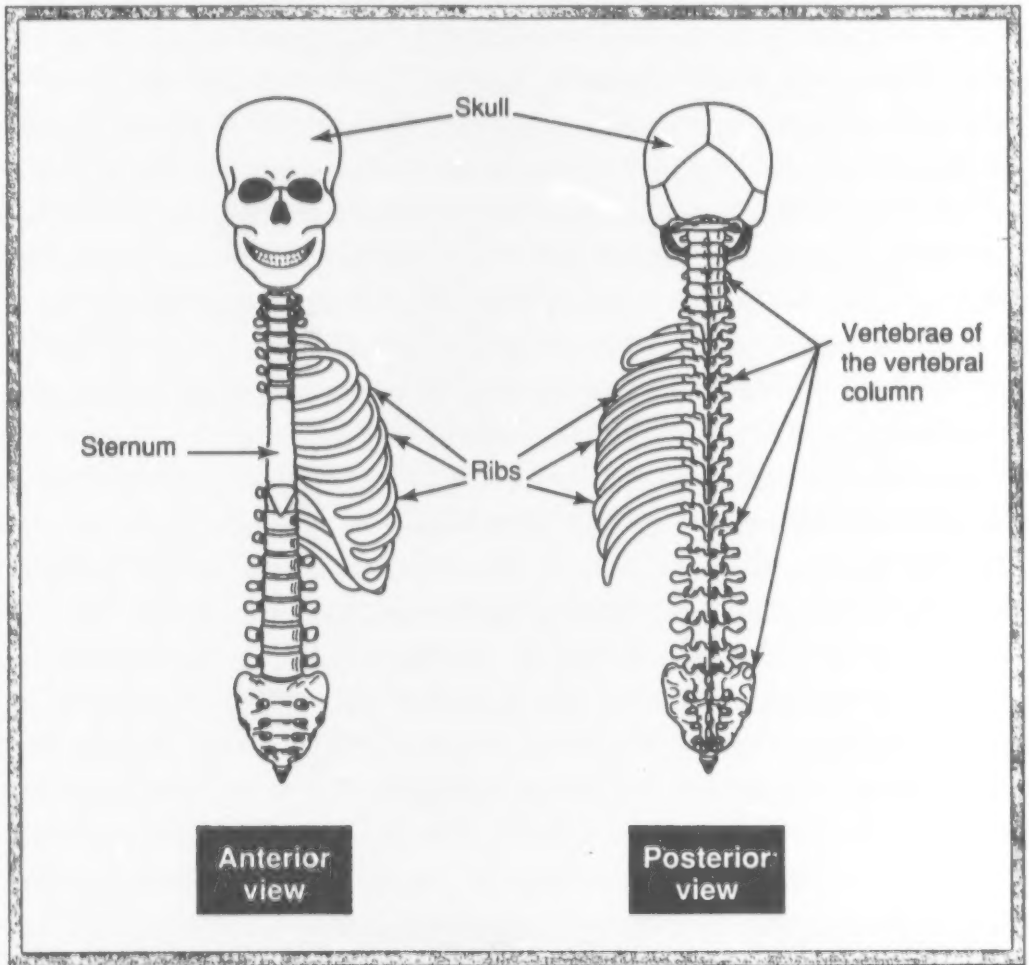


Figure 14
Axial skeleton

OBJECTIVE 13 **Label the major bones of the anterior and posterior appendicular skeleton** (see Figure 15).

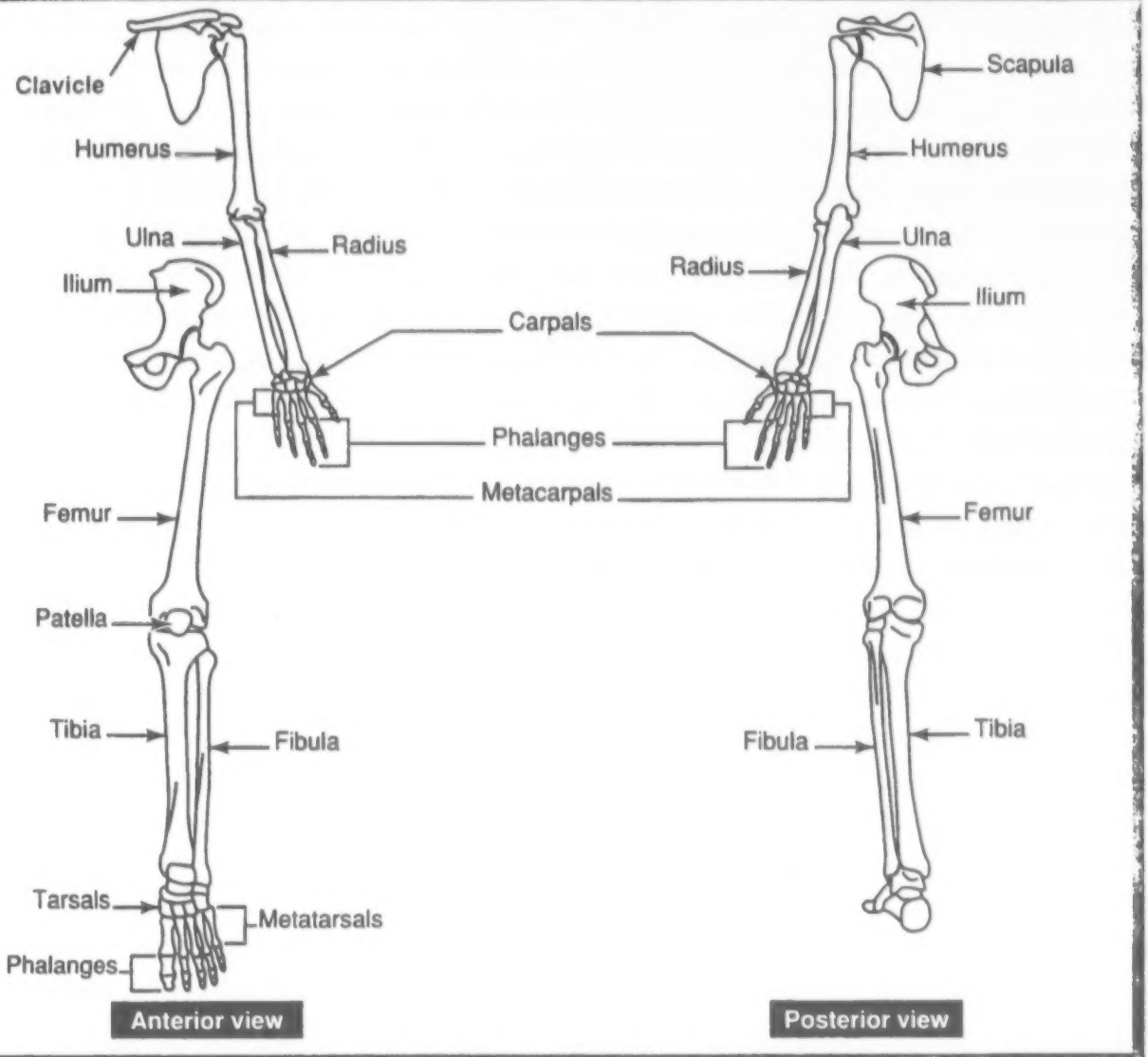


Figure 15
Appendicular skeleton

KEY TERM

Clavicle (kla´-vi-kuhl)—The collarbone

OBJECTIVE 14 **Define the major bones and structures of the cranium, face, and ear.**

KEY TERM

Cranium (kra´-ne-uhm)—The bony part of the skull that holds the brain

✔ **NOTE:** The cranium is composed of eight bones: the frontal, occipital, sphenoid, and ethmoid bones and the paired temporal and parietal bones.

1. **Major bones and structures of the cranium** (see Figure 16 on page 24)

   - **Frontal bone**—A single bone that forms the front of the skull
   - **Occipital** (awk-si´-puh-tuhl) **bone**—The cuplike bone at the back of the skull that is marked by a large opening by which the skull articulates with the **atlas**

KEY TERM

Atlas (at´-luhs)—The first vertebra of the neck

   - **Parietal** (puh-ri´-uh-tuhl) **bone**—Either of a pair of bones of the roof of the skull between the frontal bone and the occipital bone
   - **Temporal** (tem´-puh-ruhl) **bone**—Either of a pair of compound bones at the side of the skull that contains various cavities and recesses associated with the ear
   - **Sphenoid** (sfe´-noid) **bone**—The winged compound bone of the base of the skull and anterior to the temporal bone
   - **Ethmoid** (eth´-moid) **bone**—A light, spongy, cubical bone forming much of the walls of the nasal cavity and part of those of the **orbits**

KEY TERM

Orbit (or´-bit)—One of a pair of bony, conical cavities in the skull that accommodate the eyeballs and associated structures

   - **Coronal** (kor´-uh-nuhl) **suture**—The suture extending across the skull between the parietal and frontal bones

     ✔ **NOTE:** During embryonic development, the bones of the skull begin as fibrous connective tissue that produces osteoblasts in about the third month of development. Calcium salts are deposited in the tissue to produce ossification. Even at birth, the skull has not fully ossified. The edges of each plate remain cartilaginous so that the skull can compress and flex during birth. These areas of cartilage are referred to as *fontanels* (fant´-uhn-els), and they become the sutures of the skull at around two years of age.

- **Lambdoidal** (lam´-doid-uhl) **suture**—The serrated suture between the occipital bone and the parietal bones of the skull
- **Zygomatic** (zi-guh-ma´-tik) **process**—The process of a temporal bone that extends toward a zygomatic bone

  ✔ **NOTE:** See the next section for the definition of the zygomatic bones.
- **Mastoid** (mas´-toid) **process**—The process of a temporal bone that extends behind an ear

2. **Major bones and structures of the face** (see Figure 17 on the next page)
   - **Maxilla** (mak´-si-luh)—One of a pair of large bones that form the upper jaw
   - **Nasal bone**—The bone forming the nasal cavity
   - **Lacrimal** (la´-kruh-mal) **bone**—One of the smallest and most-fragile bones of the face, located at the anterior part of the medial wall of the orbit
   - **Mandible** (man´-duh-buhl)—The large bone that forms the lower jaw
   - **Alveolar** (al-ve´-uh-ler) **process**—The portion of the maxilla or the mandible that forms the dental arch
   - **Zygomatic bone**—One of a pair of bones that forms the prominence of the cheek and part of the orbit; a cheekbone
3. **Major bones of the ear** (see Figure 18 on page 25)
   - **Malleus** (ma´-le-uhs)—One of the three bones of the middle ear, resembling a hammer with a head, neck, and three processes

     ✔ **NOTE:** The malleus is connected to the eardrum and transmits sound vibrations to the incus.
   - **Incus** (in´-kus)—One of the three bones of the middle ear, resembling an anvil

     ✔ **NOTE:** The incus communicates sound vibrations from the malleus to the stapes.
   - **Stapes** (sta´-pez)—One of the three bones of the middle ear, resembling a tiny stirrup

     ✔ **NOTE:** The stapes transmits sound vibrations from the incus to the internal ear.

OBJECTIVE 15 **Label the major bones and structures of the cranium, face, and ear** (see Figure 16 through Figure 18).

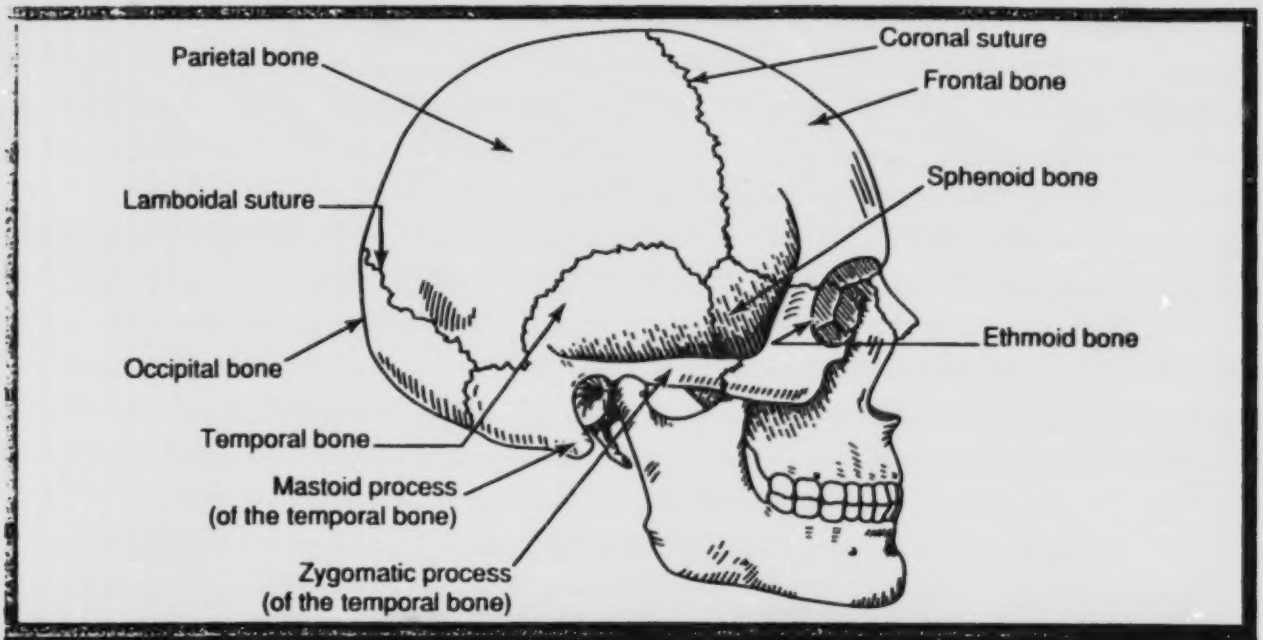


Figure 16
Major bones and structures of the cranium

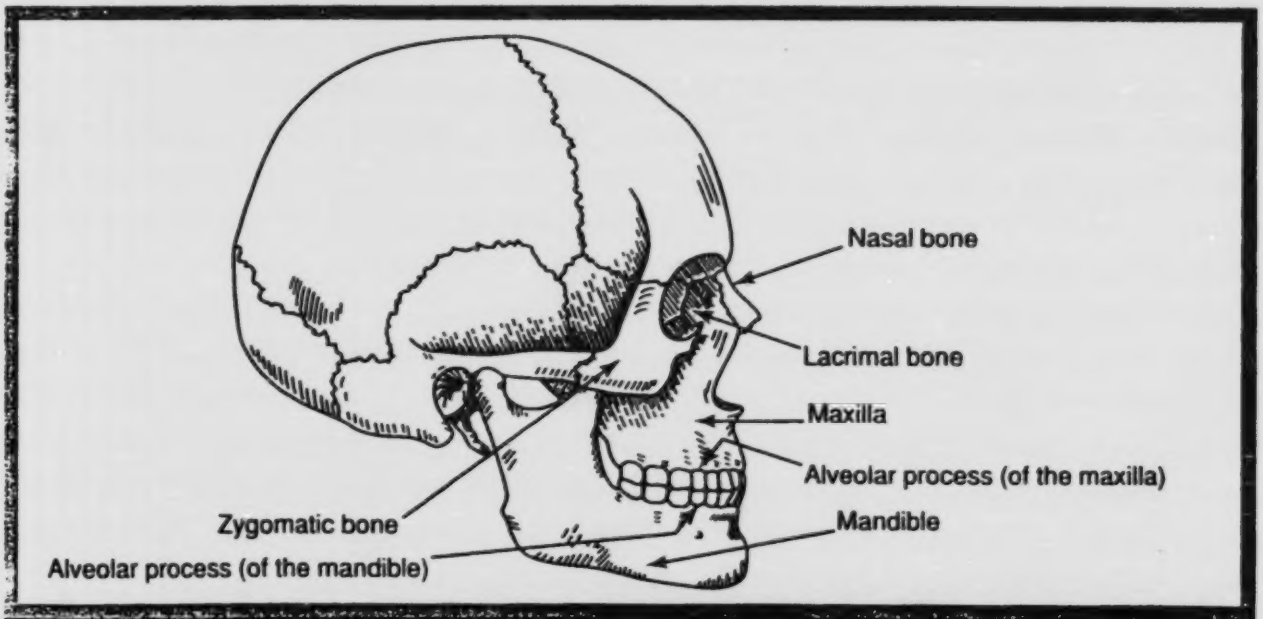


Figure 17
Major bones and structures of the face

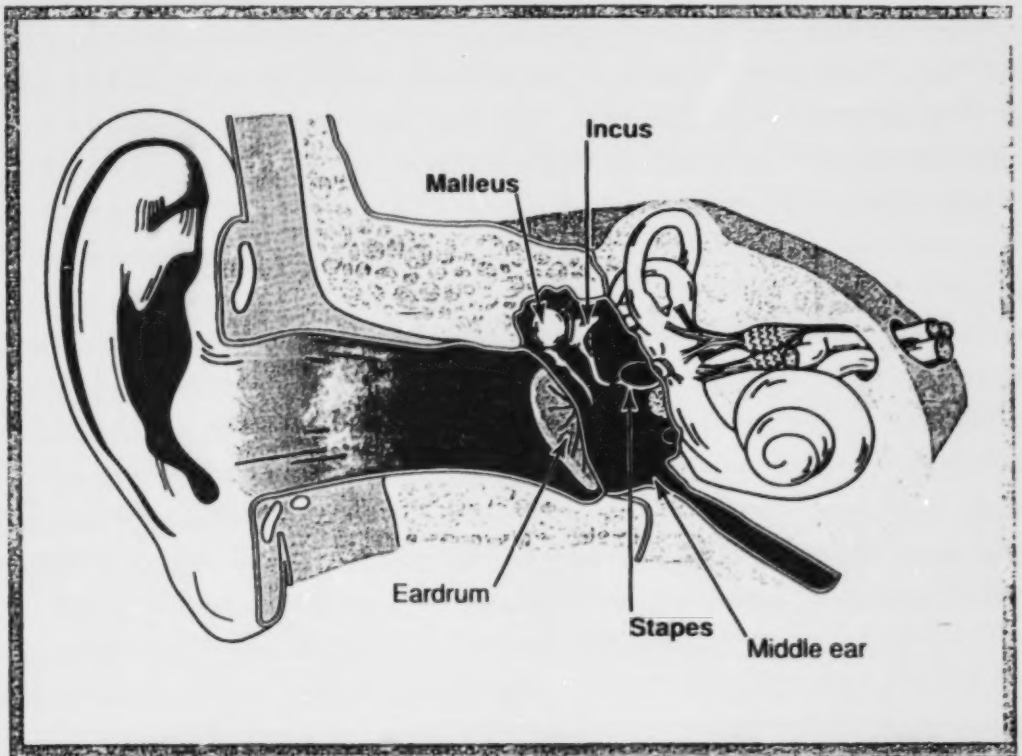


Figure 18
Major bones of the ear

OBJECTIVE 16

State the characteristics of the hyoid bone.

1. **The hyoid (hi´-oid) bone is considered to be part of the axial skeleton.**
2. **The hyoid bone is a single, U-shaped bone in the neck between the mandible and the upper part of the larynx.**

KEY TERM

Larynx (lar´-in{k}s)—The organ of voice that is part of the air passage

3. **The hyoid bone is the only bone in the body that does not articulate with another bone.**
4. **The hyoid bone is suspended by ligaments on processes from the temporal bone in the cranium.**
5. **The hyoid bone provides an attachment for the tongue.**

OBJECTIVE 17

Define the regions and the major bones and structures of the vertebral column (see Figure 19 on page 28).

1. **Regions of the vertebral column**

   - **Cervical** (suhr´-vi-kuhl) **region**—The region consisting of the first seven segments of the vertebral column, designated C1 to C7
   - **Thoracic** (thuh-ra´-sik) **region**—The region consisting of 12 segments of the upper-back portion of the vertebral column, designated T1 to T12

     ✔ **NOTE:** The vertebrae of the thoracic region are separated by discs, and the vertebrae become thicker and heavier in descending order from T1 to T12.
   - **Lumbar** (luhm´-bar) **region**—The region consisting of the five largest segments of the movable part of the vertebral column, designated L1 to L5
   - **Sacral** (sa´-kruhl) **region**—The region consisting of five segments of the vertebral column that fuse in the adult to form the sacrum
   - **Coccygeal** (kak-si´-je-uhl) **region**—The region consisting of four segments of the vertebral column that fuse to form the adult coccyx; the segments of this region are considered **rudimentary** vertebrae

KEY TERM

Rudimentary (ru-duh-men´-tuh-re)—Very imperfectly developed; relatively useless

✔ **NOTE:** A rudimentary structure is a structure of the body that had a vital function at an earlier stage of life or in a more-primitive form of life.

2. **Major bones and structures of the vertebral column**

   - **Atlas**—The first cervical vertebra that articulates with the occipital bone and the axis

     ✔ **NOTE:** The atlas supports the skull and allows flexion, extension, and rotation of the head.
   - **Axis**—The second cervical vertebra about which the atlas rotates, allowing the head to be turned, extended, and flexed

     ✔ **NOTE:** The axis allows side-to-side rotation of the head.
   - **Vertebral body**—The weight-supporting, solid central portion of a vertebra
   - **Transverse process**—One of the bony projections extending at a right angle from a vertebral body
   - **Spinous** (spi´-nuhs) **process**—The bony projection extending posteriorly from a vertebral body

- **Intervertebral disc**—One of the fibrous discs found between adjacent vertebrae, except for the axis and the atlas

  ✔ **NOTE:** The discs vary in size, shape, thickness, and number, depending on the location in the back and on the particular vertebrae they separate.

- **Sacrum** (sa´-kruhm)—The large, triangular bone at the dorsal part of the pelvis, inserted like a wedge between the two hip bones

  ✔ **NOTE:** The base of the sacrum articulates with the last lumbar vertebra, and its apex articulates with the coccyx.

- **Coccyx** (kak´-siks)—The beaklike bone joined to the sacrum by a disc of fibrocartilage at the base of the vertebral column

OBJECTIVE 18 **Label the regions and the major bones and structures of the vertebral column** (see Figure 19).

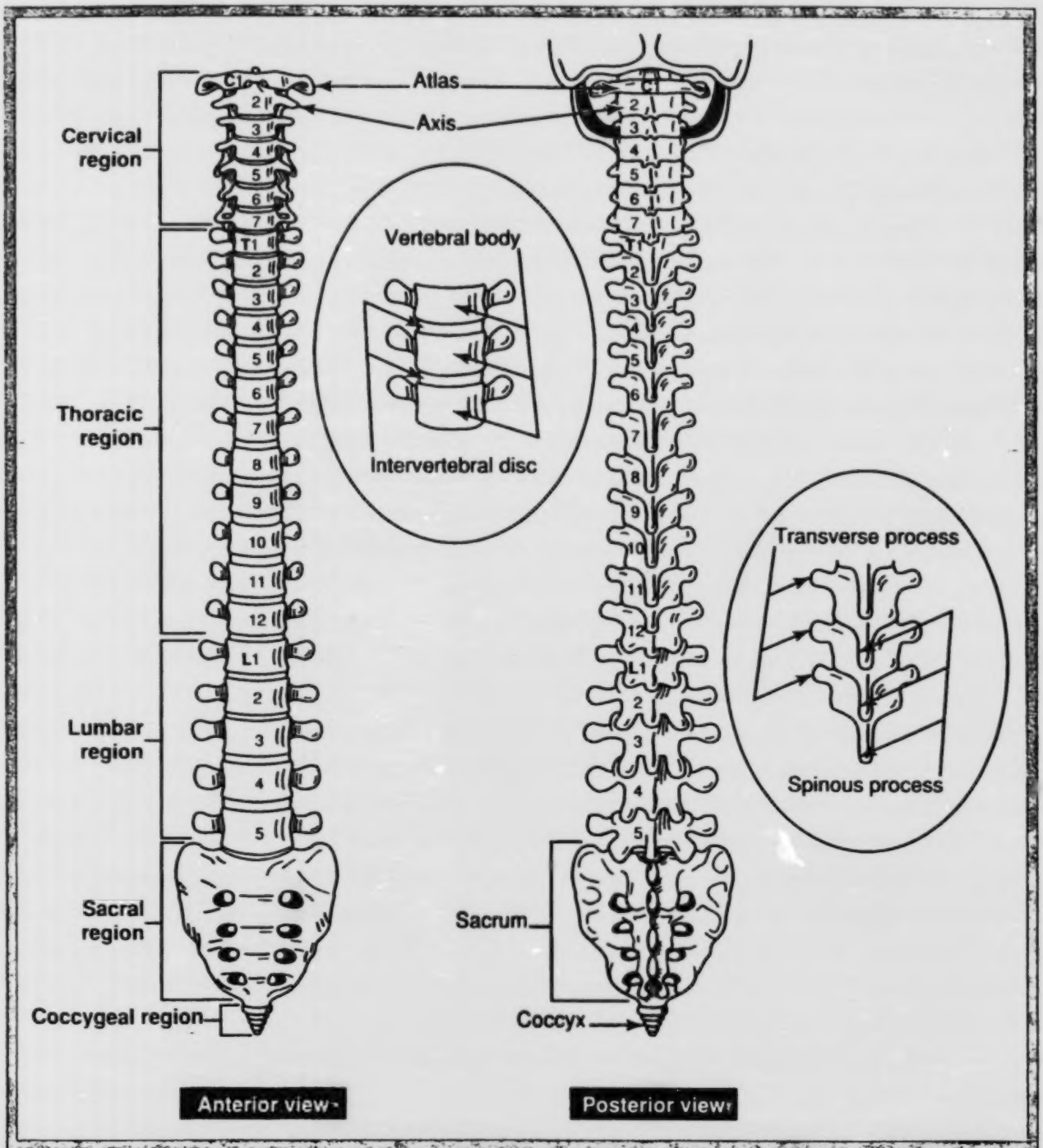


Figure 19
Regions and major bones and structures of the vertebral column

OBJECTIVE 19

Complete statements that describe the characteristics of the ribs and sternum.

1. **Ribs** (see Figure 20-a and Figure 20-b on the next page)

   - All ribs attach to the thoracic region of the vertebral column.
   - There are 12 rib pairs.
   - The upper 7 rib pairs attach directly to the sternum; these are known as the *true ribs*.
   - The lower 5 rib pairs (rib pairs 8 through 12) are referred to as the *false ribs*.
   - Rib pairs 11 and 12 are not attached to the sternum and are called the *floating ribs*.
   - Rib pairs 8, 9, and 10 attach to the costal cartilage of the seventh rib.

2. **Sternum** (see Figure 20-b on the next page)

   - The top section of the sternum is called the *manubrium* (muh-nu´-bre-uhm), and it provides the attachment for rib pair 1.
   - The middle (body) section of the sternum is called the *gladiolus* (gla-de-o´-luhs), and it provides the attachment for rib pairs 2 through 7.
   - The lowest section of the sternum is called the *xiphoid* (zi´-foid) *process*.

OBJECTIVE 20 | **Label the major bones and structures of the ribs and sternum** (see Figure 20).

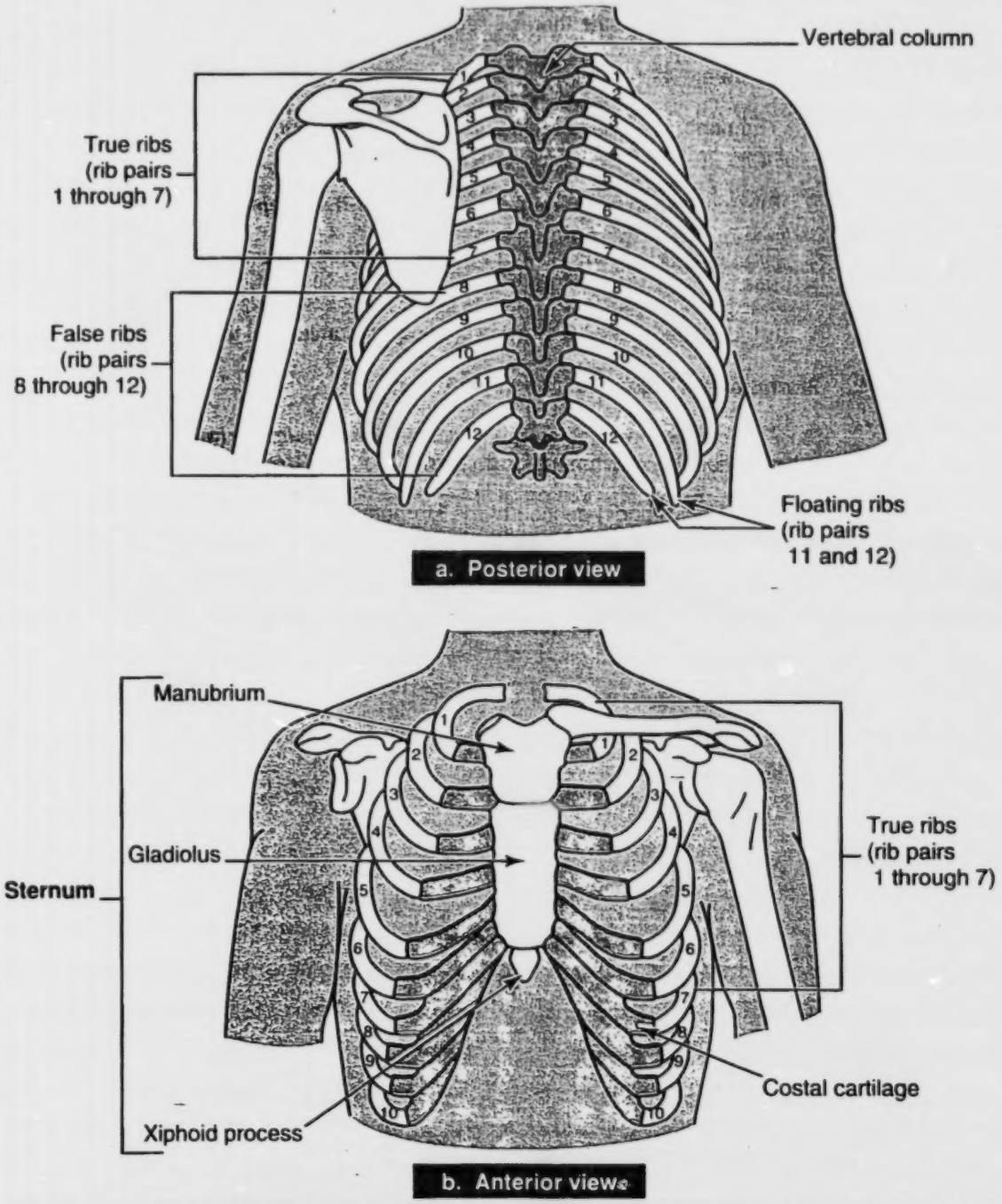


Figure 20
Major bones and structures of the ribs and sternum

OBJECTIVE 21

Define the term *articular system.*

- Articular **system**—The structures that create joints between bones that allow movement of the body parts

KEY TERM

Articular (ar-ti´-kyuh-luhr)—Relating to a joint or the involvement of joints

OBJECTIVE 22

State the functions of the articular system.

1. **Allows changes of position and body motion**
2. **Bears the weight of the body**
3. **Provides stability**

✔ **NOTE:** The structures of the articular system provide additional strength to a joint, helping it to move only in the intended direction and to hold a position at any point in the movement.

4. **Lubricates the joints**
5. **Nourishes the cartilaginous structures**

✔ **NOTE:** Synovial (suh-no´-ve-uhl) fluid provides lubrication for the joints and helps to transport nutrients to the cartilage. You will study more about synovial fluid in the next objective.

OBJECTIVE 23

Complete statements that describe the major structures and substances of the articular system.

1. **Ligaments**
   - Ligaments are connective tissue bands that hold bones together.
   - Ligaments are found in connection with all the freely movable joints and in many of the less-movable joints.
   - Ligaments help to reinforce and stabilize the joints.
2. **Articular cartilages** (see Figure 21 on the next page)
   - Articular cartilages are smooth layers of cartilage that cover the ends of opposing bones.
   - Articular cartilages are found where bones meet adjacent bones.
   - Articular cartilages provide a smooth gliding surface for opposing bones.

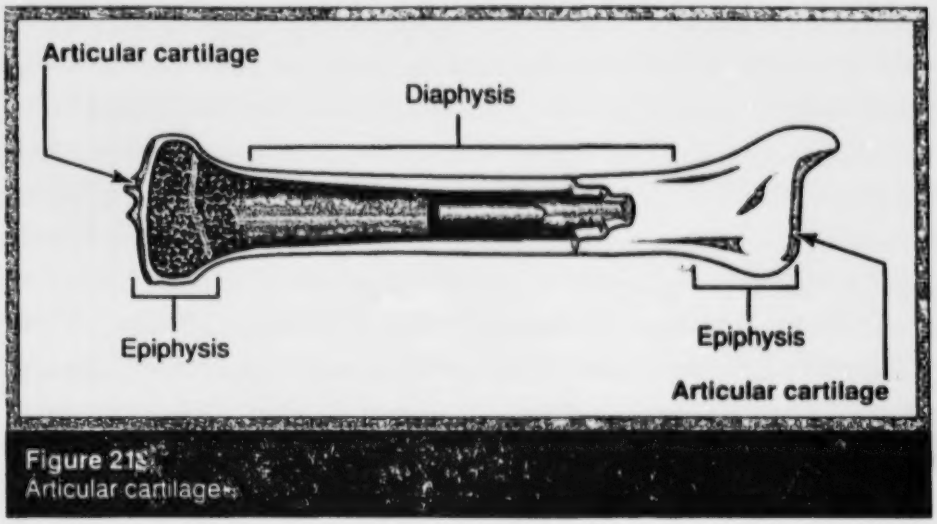


Figure 21S
Articular cartilage

3. **Synovial fluid**

- Synovial fluid is a thick, colorless fluid that resembles the white of a raw egg.
- Synovial fluid is secreted by the synovial membrane, which is a thick, vascular connective tissue lining the inner surface of a joint capsule.
- Synovial fluid acts as a shock absorber.
- Synovial fluid provides a lubricated articulating surface for the adjacent bone.
- Synovial fluid provides the major source of nutrition for the articular cartilage.

OBJECTIVE 24 **Distinguish among phrases that describe the types of articulations.**

KEY TERM

Articulation (ar-ti-kyuh-la´-shuhn)—A joint or junction between bones or cartilages in the skeleton

✔ **NOTE:** There are three types of articulations: synarthrosis (sin-ar-thro´-suhs), amphiarthrosis (am-fi-ar-thro´-suhs), and diarthrosis (di´-ar-thro´-suhs). Articular joints are classified by their makeup, which in turn affects their freedom of movement.

1. **Synarthrosis articulations**

- Are immovable
- Do not have a joint cavity

- Consist of fibrous cartilage or bone tissue that grows between the articulating surfaces
- Include sutures in the skull, facial bones, and the distal tibiofibular joint

2. Amphiarthrosis articulations

- Are slightly movable
- Include two types: symphysis and synchrondrosis (see Objective 25)

3. Diathrosis articulations

- Are freely movable
- Have a joint cavity enclosed by an articular cavity
- Have ligaments that cover and connect the ends of the opposing bones
- Have synovial fluid
- Include the hip and femur joint, knee, wrist, elbow, and shoulder joints
- Include six types: ball-and-joint socket, hinge joint, pivot joint, condyloid joint, saddle joint, and gliding joint (see Objective 26)

OBJECTIVE 25 **Describe types of amphiathrosis articulations.**

1. Symphysis (sim´-fuh-suhs) **joint**

- Consists of bones growing together at a midline
- Includes the pubis joint and the joints between the vertebrae

2. Synchrondrosis (sin-kron-dro´-suhs) **joint**

- Is held together by cartilage
- Includes the joints between the ribs and sternum

OBJECTIVE 26 **Match types of diathrosis articulations to their correct descriptions.**

1. Ball-and-joint socket

- Has a ball-shaped head that fits into a concave cavity
- Provides the widest range of motion with movement in all planes in addition to rotation
- Includes the hip and femur joint and the humerus and scapula joint

2. **Hinge joint**
   - Has a convex surface that fits into a concave cavity
   - Provides angular movement in one direction
   - Motion is limited to flexion and extension in a single plane
   - Includes the knee, elbow, and finger joints
3. **Pivot joint**
   - Has a process that rotates around a bony fossa around a longitudinal axis
   - Motion is limited to uniaxial rotation
   - Includes rotation of the head and the joint between the radius and ulna
4. **Condyloid joint**

KEY TERM

Condyloid (kawn´-duh-loid)—Resembling a knuckle

✔ **NOTE:** A condyloid joint may also be called an *ellipsoidal* (i-lip-soi´-duhl) *joint.*

   - Has an oval-shaped process that fits into an elliptical cavity
   - Motion is possible in two planes at right angles to each other
   - Includes the wrist joint between the radius and the carpal bones
5. **Saddle joint**
   - Has articular surfaces with each bone concave in one direction and convex in the other
   - Provides movement in two directions
   - Includes the joint between the carpals and the thumb metacarpals
6. **Gliding joint**
   - Has flat articular surfaces or matching slightly concave and slightly convex surfaces
   - Does not permit axial motion
   - Includes the joints between the carpals and between the tarsals

1067

OBJECTIVE 27

Match common disorders and abnormalities of the skeletal system to their correct definitions.

1. **Arthritis** (ar-thri´-tuhs)—A disease that leads to inflammation of the joints, resulting in stiff, painful joints

2. **Scoliosis** (sko-le-o´-suhs)—Side-to-side curvature of the spinal column

   ✔ **NOTE:** All three conditions of spinal curvature—scoliosis, kyphosis, and lordosis— can result in poor posture and breathing difficulty due to compression of the lungs and other organs. These conditions may result from poor posture during the growth years or various diseases and injuries. Kyphosis often occurs with advanced age.

3. **Kyphosis** (ki-fo´-suhs)—Exaggerated curvature of the spinal column in the thoracic region

4. **Lordosis** (lor-do´-suhs)—Exaggerated curvature of the spinal column in the lumbar region

5. **Herniated** (huhr´-ne-at-uhd) **disc**—A condition in which the outer layer of the fibrous cartilage between vertebrae ruptures, resulting in stiffness, severe pain, and interference with nerve functioning

6. **Osteoporosis** (as-te-o-puh-ro´-suhs)—A condition in which bone matrix is lost and not replaced, resulting in weakened bones and possible curvature of the spine

7. **Bursitis** (buhr-si´-tuhs)—An inflammation of the sac of synovial fluid that is found between some tendons and bones

8. **Cleft palate** (kleft pa´-luht)—A congenital condition in which the bones that separate the oral and nasal cavities do not fuse

9. **Ricketts** (ri´-kuhts)—A deficiency of vitamin D that can often lead to poor or abnormal bone growth in children

10. **Osteochondroma** (as-te-o-kan´-dro-muh)—A **neoplasm** of the bone that usually exhibits itself as a spur on a long bone and that generally remains benign

11. **Osteosarcoma** (as-te-o-sar-ko´-muh)—A neoplasm of the bone that is usually **malignant** and **metastatic**

KEY TERMS

Neoplasm (ne´-uh-pla-zuhm)—An abnormal cellular growth; a tumor

Malignant (muh-lig´-nuhnt)—Tending to spread and become more severe, especially of cancer

Metastatic (me-tuh-sta´-tik)—Prone to metastasis—the spread of a disease from one region of the body to another

12. **Chondrosarcoma** (kan-dro-sar-ko´-muh)—A neoplasm of the hyaline cartilage that is usually malignant

13. **Osteomalacia** (as-te-o-muh-la´-shuh)—A bone disease characterized by poor mineralization of the bone

14. **Paget's** (pa´-jets) **disease**—A condition of older adults in which there is a rapid and disorganized increase in **osteoclasts**

15. **Osteomyelitis** (as-te-o-mi-uh-li´-tuhs)—An inflamed condition of a bone caused by infection with a pathogen

16. **Mastoiditis** (mas-toi-di´-tuhs)—An inflammation of the air spaces in the mastoid region of the temporal bone

KEY TERMS

Hyaline (hi´-uh-luhn) **cartilage**—The most-common type of cartilage; translucent bluish-white cartilage found on the bones, in most joints, and in the nasal passages

Mineralization (min´-ruh-luh-za´-shuhn)—The process of a substance converting to or absorbing inorganic substances, such as salts

Osteoclast (as´-te-uh-klast)—A cell that breaks down bone by reabsorbing bone matrix as part of the growth-and-repair process

OBJECTIVE 28

Assignment Sheet 1—Classify Bone Fractures

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Fractures were identified correctly using the correct medical terms	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

Extreme pressure can cause the bones to break or crack, a condition generally referred to as a *fracture*. Bones may also break for no apparent reason—though often a causative disease is later identified. These breaks are referred to as *spontaneous fractures*. Fractures are classified by the bone involved and by certain characteristics of the fracture itself. Three principal characteristics are used to classify bone fractures: (1) the relationship of the portions of bone on each side of the fracture, (2) the extent of the separation between the portions of the bone, and (3) the geometry of the fracture. These characteristics are summarized below.

Relationship of the bones

- **Simple fracture**—A fracture in which the portions of bone on each side of the fracture maintain their normal relationship to each other, there is no significant displacement of surrounding tissue, and the overlying skin remains intact

  ✔ **NOTE:** This type of fracture is also referred to as a *closed fracture*.

- **Compound fracture**—A fracture in which at least one section of bone has been severely displaced and has punctured the overlying skin and there is serious damage to the surrounding tissue

  ✔ **NOTE:** This type of fracture is also referred to as an *open fracture*.

- **Impacted fracture**—A fracture in which the two parts of the bone have been forced into one another, likely resulting in several bone fragments that may result in exposed pieces of bone on the surface of the skin

- **Comminuted** (kawm´-uh-n{y}ut-uhd) **fracture**—A fracture with multiple, intersecting breaks within a bone that have led to several bone fragments

Extent of separation

- **Complete fracture**—A fracture in which the bone separates into two or more distinct parts
- **Incomplete fracture**—A fracture in which part of the bone at the location of the fracture remains intact so that there is not complete separation

Geometry of the fracture (see Figure 1 below)

- **Linear fracture**—A fracture that runs parallel to the long axis of a bone

  ✔ **NOTE:** This type of fracture is sometimes referred to as a *longitudinal fracture* or as a *greenstick break* or as a *greenstick fracture.*

- **Transverse fracture**—A fracture that runs perpendicular to the long axis of a bone
- **Oblique fracture**—A fracture that runs at an angle that is neither perpendicular nor parallel to the long axis of a bone

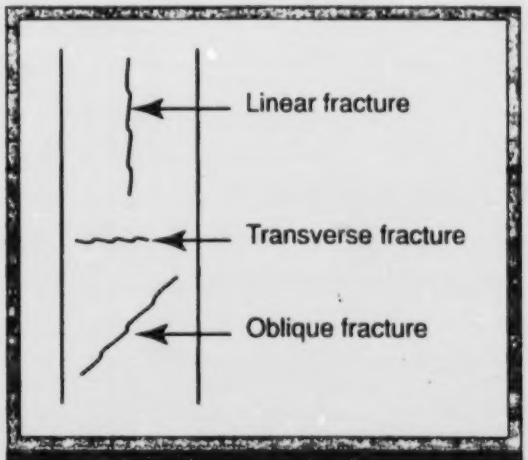


Figure 1
Geometry of a fracture

✔ **NOTE:** In the case of comminuted fractures where the breaks intersect each other, more than one type of geometry may be exhibited. Similarly, multiple fractures may result in multiple relationships and amounts of separation.

EXERCISE

ACTIVITY CHECKLIST

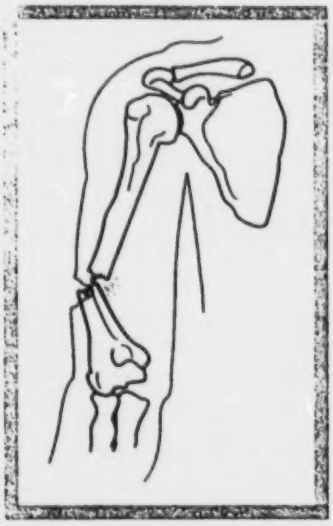
Put a checkmark on the blank line before each activity below as you complete it.

_____ 1. Study the information in the introduction to this assignment sheet.

_____ 2. Study the illustrations in each of the following problems, and on the blank lines provided within each problem, use the terms you have learned in the introduction to describe the fractures illustrated.

_____ 3. Complete the assignment and give it to your instructor for evaluation.

PROBLEM 1



a. Relationship of the bones— _____

b. Extent of separation— _____

c. Geometry of the fracture— _____

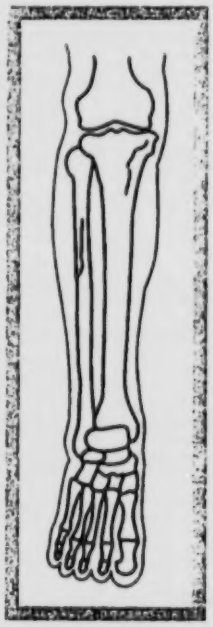
PROBLEM 2

a. Relationship of the bones— _____

b. Extent of separation— _____

c. Geometry of the fracture— _____

PROBLEM 3



a. Relationship of the bones— _____

b. Extent of separation— _____

c. Geometry of the fracture— _____

PROBLEM 4

a. Relationship of the bones— _____

b. Extent of separation— _____

c. Geometry of the fracture— _____

PROBLEM 5

a. Relationship of the bones— _____

b. Extent of separation— _____

c. Geometry of the fracture— _____

OBJECTIVE 29

Assignment Sheet 2—Practice Critical Thinking: Research the Current Medical Understanding of the Causes and Treatments of Rheumatoid Arthritis

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Presentation of research findings followed agreed-upon format	_____
• Presentation of research findings met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

An abnormality of the skeletal system that often occurs as part of the aging process is rheumatoid arthritis, which is generally evidenced by a stiffening of the joints. However, this form of arthritis can occur at any age. The crippling disease can so severely deplete the joints of synovial membrane that the joints stiffen, in some cases resulting in fused bones. This is especially true of rheumatoid arthritis in the joints of the extremities and of the fingers in particular.

Medical researchers are uncertain of the exact cause of rheumatoid arthritis. Some suspect that it is an autoimmune disease—a condition in which the body's immune system attacks normal cells. Because the cause of this condition is not known, treatment focuses on reducing the inflammation of the joints and managing the associated pain. In this assignment sheet, you will determine the latest medical findings with regard to the causes and treatments of rheumatoid arthritis.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review Objective 27 in the Information Sheet.

_____ 2. Check with your instructor, who will direct you to resources that will allow you to research the latest medical findings with regard to the causes and

treatments of rheumatoid arthritis. List your assigned resources on the blank lines below.

_____ 3. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in reporting your research findings. Describe that format on the blanks provided below.

_____ 4. Check with your instructor to agree upon the criteria he or she will use to evaluate your research-findings report. Describe those criteria on the blanks provided below.

_____ 5. Complete your research-findings report and return it to your instructor for evaluation.

Assigned-resources listing _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Format for research-findings report _____

_____

_____

_____

_____

Evaluation criteria for research-findings report _____

_____

_____

_____

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_____

MODULE SET II:
Major Body Systems

Module 3:: Muscular System

1077

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheets	
1—Practice Critical Thinking: Determine Common Intramuscular Injection Sites	27
2—Practice Critical Thinking: Report on Disorders and Abnormalities of the Muscular System	31

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 20.
- ❑ 5. **Research** Online resources to learn more about the muscular system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Determine Common Intramuscular Injection Sites."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Do** Assignment Sheet 2, "Practice Critical Thinking: Report on Disorders and Abnormalities of the Muscular System."
- ❑ 11. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 12. If the evaluation is not satisfactory, repeat step 10.

❑ 12.	**Check**	With your instructor for any additional assignments to be completed.
❑ 13.	**Do**	Additional assignments your instructor lists below.

_____

_____

_____

❑ 14.	**Take**	Module Review provided by your instructor.
❑ 15.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 16.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheets, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to identify and define the major structures and functional characteristics of muscles and to identify and state the functions of the major muscles of the major muscle groups. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *muscular system.*
2. State the functions of the muscular system.
3. Describe the major classifications of muscle tissue.
4. Define the major structures of skeletal muscles.
5. Label the major structures of skeletal muscles.
6. Complete statements that describe the characteristics of the bone/muscle attachments of skeletal muscles.
7. Complete statements that describe how skeletal muscles function.
8. Define terms that describe the functional characteristics of muscle tissue.
9. State the actions performed by the types of muscles as classified by their actions.
10. Define terms that describe how muscles function during coordinated movement.
11. State the functions of the major muscle groups.
12. State the functions of the major muscles of the neck, head, and face.
13. Label the major muscles of the neck, head, and face.
14. State the functions of the major muscles of the torso.
15. Label the major muscles of the torso.
16. State the functions of the major muscles of the arms.
17. Label the major muscles of the arms.
18. State the functions of the major muscles of the legs.
19. Label the major muscles of the legs.

20. Match common disorders and abnormalities of the muscular system to their correct definitions.

21. Practice critical thinking: determine common intramuscular injection sites. (Assignment Sheet 1)

22. Practice critical thinking: report on disorders and abnormalities of the muscular system. (Assignment Sheet 2)

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Information Sheet

OBJECTIVE 1

Define the term *muscular system*.

- **Muscular system**—All of the muscles of the body considered as an interrelated structural group (see Figure 1)

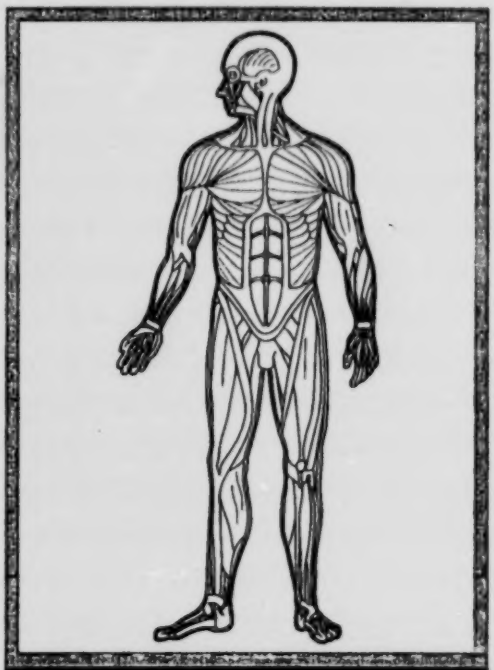

Figure 1
Muscular system

OBJECTIVE 2

State the functions of the muscular system.

1. **Assists in body movements**

   ✔ **NOTE:** A body movement may involve a complex series of actions involving numerous large muscle groups, such as walking or jogging, or it may be a small movement such as adjusting the opening of the pupil in the eye in response to changes in light level.

2. **Assists in the movement of materials internal to the body**

   ✔ **NOTE:** The blood is moved by the pumping of the heart's cardiac muscles. The smooth muscles of the stomach and intestines move food through the digestive tract. Even the skeletal muscles assist with materials movement as part of the power to transport lymph is produced by the action of skeletal muscles.

3. **Produces heat and energy**

   ✔ **NOTE:** The muscles represent the largest mass of tissue in the body; therefore, much of the body's cellular respiration takes place in muscle cells.

4. **Assists in maintaining posture and balance**

5. **Helps to protect the internal organs**

OBJECTIVE 3 **Describe the major classifications of muscle tissue.**

✔ **NOTE:** There are three major classifications of muscle tissue: skeletal, visceral, and cardiac. Muscle tissues can be distinguished from one another in a number of ways and in particular whether they are **voluntary** or **involuntary**, their cellular structure, their location (which also involves their function), and the speed of their response to nerve impulses.

1. **Skeletal muscle tissue** (see Figure 2 on the next page)

   - Is voluntary
   - Is **striated**, consisting of long, slender, striped cells
   - Is attached to the skeleton and moves the skeleton's moving parts, acting in opposing groups with some muscles relaxing and some contracting
   - Contracts quickly in response to stimulation of nerve impulses

KEY TERMS

Voluntary (vawl´-uhn-ter-e)—Functioning under the conscious control of the organism

Involuntary (in-vawl´-uhn-ter-e)—Functioning without the conscious control of the organism

✔ **NOTE:** The terms *voluntary* and *involuntary* are a bit misleading in that most muscles exhibit both voluntary and involuntary responses. For example, the muscles that assist with breathing—the rib muscles and the diaphragm—are voluntary muscles in that people may hold their breath or consciously breathe deeply or in shallow breaths. However, a person does not have to consciously decide to breathe in and breathe out. Further, the body will automatically resume breathing if a person's breath is held too long. Similarly, the skeletal muscles that move the limbs are voluntary muscles, but if a person touches a hot stove, the muscles will make an involuntary response to pull away from the source of pain.

Striated (stri´-at-uhd)—Consisting of narrow bands or rows

✔ **NOTE:** In the case of striated muscles, the cells are aligned in rows.

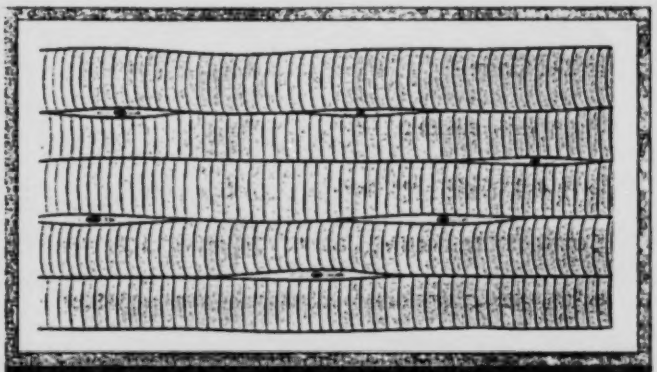

Figure 2
Skeletal muscle tissue (striated tissue)

2. **Visceral** (vis´-uh-ruhl) **muscle tissue (smooth muscle tissue)** (see Figure 3 below)

   - Is involuntary
   - Is non-striated, consisting of spindle-shaped cells
   - Is found in the **viscera**, especially the stomach, intestines, urinary ducts, and blood vessels
   - Contracts slowly in response to stimulation to nerve impulses

KEY TERM

Viscera (vis´-uh-ruh)—The internal organs in the abdominal cavity

Examples: liver, intestine, stomach

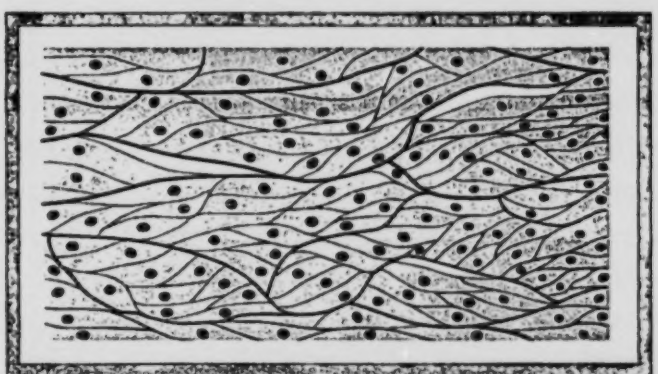

Figure 3
Visceral muscle tissue (smooth tissue)

3. **Cardiac muscle tissue** (see Figure 4 below)
   - Is involuntary
   - Is partially striated
   - Is found only in the heart
   - Contracts moderately fast in response to stimulation to nerve impulses

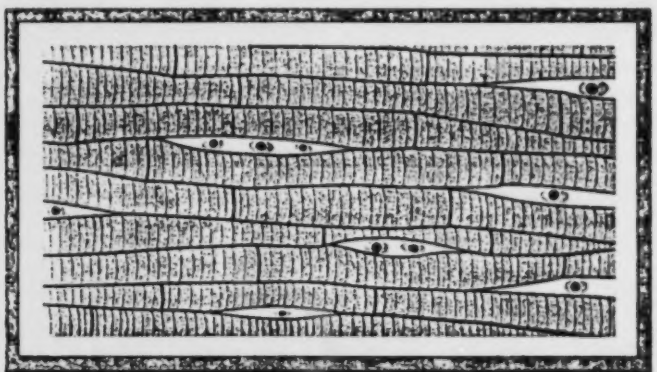

Figure 4
Cardiac muscle tissue (striated tissue)

OBJECTIVE 4 **Define the major structures of skeletal muscles** (see Figure 5 on the next page).

✔ **NOTE:** Generally, one end of a skeletal muscle is less movable than the other end. Usually, this end of the muscle, called the *origin*, is closer to the midline of the trunk of the body and is attached to the less-movable end of the bone. The other end of the muscle, called the *insertion*, is attached to the more-movable bone. The bulk of a skeletal muscle composes the *body* or *belly* of the muscle.

1. **Origin**—The less-movable end of a skeletal-muscle attachment that is closer to the midline of the trunk of the body and is attached to the less-movable end of the bone
2. **Insertion**—The end of a skeletal-muscle attachment that is attached to the more-movable bone
3. **Body** (belly)—The largest or the main part of a skeletal muscle

OBJECTIVE 5 **Label the major structures of skeletal muscles** (see Figure 5).

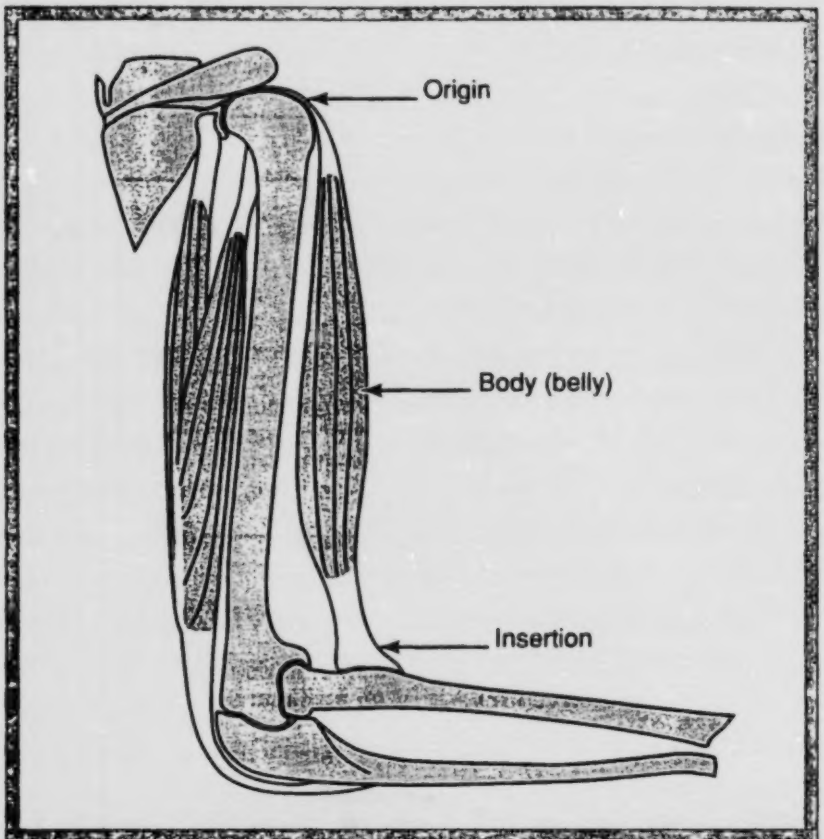

Figure 5
Major structures of skeletal muscles

OBJECTIVE 6 **Complete statements that describe the characteristics of the bone/muscle attachments of skeletal muscles.**

1. **Skeletal muscles are enclosed in the epimysium, which is continuous with the fibrous structures that attach the muscles to bones and other structures.**

KEY TERM

Epimysium (ep-uh-miz´-e-uhm)—A fibrous sheath that enfolds a skeletal muscle and extends over the origin and insertion and between bundles of muscle fibers

✔ **NOTE:** The epimysium is sturdy in some areas but more delicate in others, such as those areas where the muscle moves freely under a strong sheet of fascia. The epimysium may also fuse with fascia that attaches a muscle to a bone.

2. **Skeletal muscles are firmly attached to the structures on which they pull during contraction.**

3. **Skeletal muscles may be attached directly to the periosteum of a bone or may be attached by tendons or aponeuroses.**

KEY TERMS

Periosteum (per´-i-os-te-uhm)—A fibrous, vascular membrane covering the bones, except at their extremities

Tendon (ten´-duhn)—A structure in which the epimysium extends from the muscle as a broad, flat sheet of connective tissue that attaches to an adjacent structure; one of many white, glistening fibrous bands of tissue that attach muscle to bone

Aponeurosis (ap´-uh-nu-ro-suhs)—A structure in which the epimysium extends from the muscle as a strong, tough cord of connective tissue that is continuous with the periosteum of the bone; a strong sheet of fibrous connective tissue that serves as a tendon to attach muscles to bone or as fascia to bind muscles together

OBJECTIVE 7 **Complete statements that describe how skeletal muscles function.**

1. **Muscles contract in response to electrical impulses, either the natural stimulus of a motor-nerve impulse or an artificial stimulus such as electrical shock.**

2. **Muscles that move a body part usually lie proximal to the part that they move.**

3. **Locomotion of the body is caused by muscles pulling on bones.**

4. **Body movements result from coordinated actions in pairs of muscles.**

   Example: The coordinated movement of the biceps and triceps (see Figure 6 on the next page)

5. **The coordinated actions of a pair of muscles generally mean that one muscle contracts while the other relaxes** (see Figure 6 on the next page).

   ✔ **NOTE:** The contraction of a muscle is referred to as *flexion* or *flexing*. It involves the shortening of the muscle-tissue cells. When the cells relax, they elongate (see Figure 6 on the next page).

6. **Normal movements of body parts are the result of the coordinated motion of several pairs of muscles.**

7. **The energy to produce movement in muscles is released from simple sugars through metabolism.**

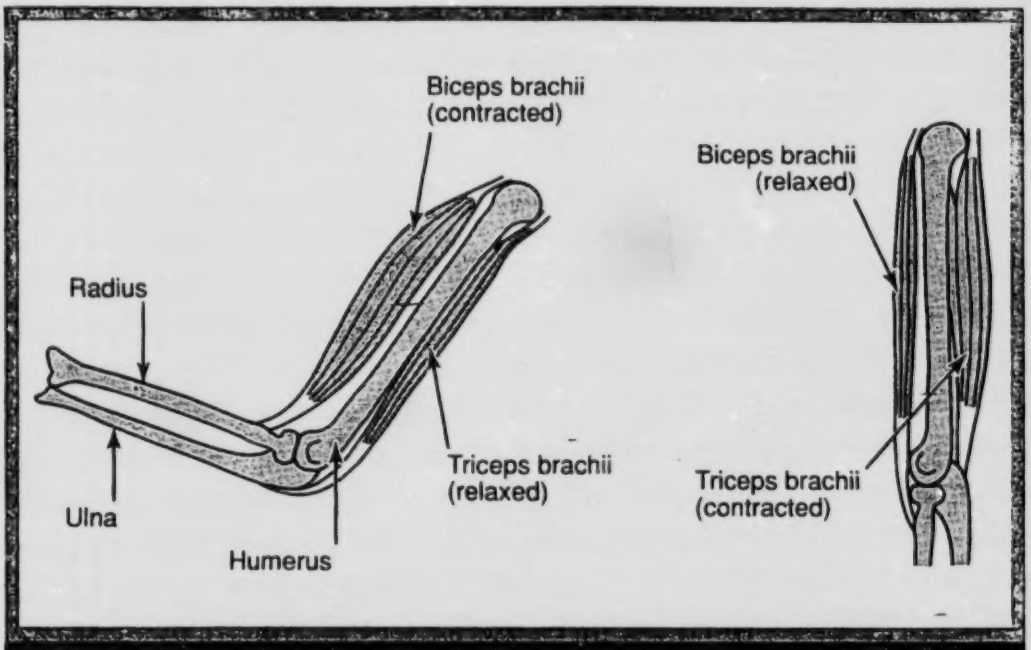

Figure 6
Coordinated movement of the biceps and triceps

OBJECTIVE 8 **Define terms that describe the functional characteristics of muscle tissue.**

1. **Irritability** (ir-uht-uh-bil´-uht-e)—The ability to respond to stimuli

   ✔ **NOTE:** Muscles contract in response to nerve impulses.

2. **Conductivity** (kawn-duhk-tiv´-uht-e)—The ability to transmit impulses

   ✔ **NOTE:** Muscle cells relay the message impulses as a ripple effect of cell reactions.

3. **Extensibility** (ik-sten-suh-bil´-uht-e)—The ability to stretch (lengthen) and remain stretched (hold)

4. **Elasticity** (i-las-tis´-uht-e)—The ability to return to a former length when the stretching force is removed

5. **Contractility** (kawn-trak-til´-uht-e)—The ability to contract or shorten

6. **Tone** (ton´)—The slight tension that is present in muscles even when they are at rest so that they can respond more easily and quickly when needed

   ✔ **NOTE:** The term *tone* is often used to indicate how prepared for response the muscles appear. Thus, someone with good muscle tone does not necessarily have well-developed muscles but does have muscles that are not flabby and do show firm, full shape. Tone is also referred to as *tonus*.

OBJECTIVE 9

State the actions performed by the types of muscles as classified by their actions.

✔ **NOTE:** Muscle types are generally referred to by the type of action they accomplish. For example, muscles that perform abduction are called *abductors*.

1. **Abductor** (ab-duhk´-tuhr)—Performs abduction, moving away from a part or a midline

   Example: Abduction of the arm (see Figure 7 below)

2. **Adductor** (uh-duhk´-ter)—Performs adduction, moving toward a part or toward a midline

   Example: Adduction of the arm (see Figure 8 below)

3. **Levator** (li-vat´-uhr)—Performs elevation, lifting a part

4. **Depressor** (di-pres´-uhr)—Performs depression, lowering a part

5. **Flexor** (flek´-suhr)—Performs flexion, bending a part at a joint

   Examples: Flexion of the arm at the elbow (see Figure 9 on the next page), plantar flexion, a toe-down movement of the foot at the ankle (see Figure 10 on the next page)

6. **Extensor** (ik-sten´-suhr)—Performs extension, straightening a part at a joint

   Example: Extension of the arm at the elbow (see Figure 11 on the next page)

7. **Rotator** (ro´-tat-uhr)—Performs medial rotation—revolving a part on its axis (see Figure 12 on the next page)—or lateral rotation—moving a part so that its distal point travels in a circle

   ✔ **NOTE:** Lateral rotation is also referred to as *circumduction* (suhr-kuhm-duhk´-shuhn).

Figure 7
Abduction of the arm

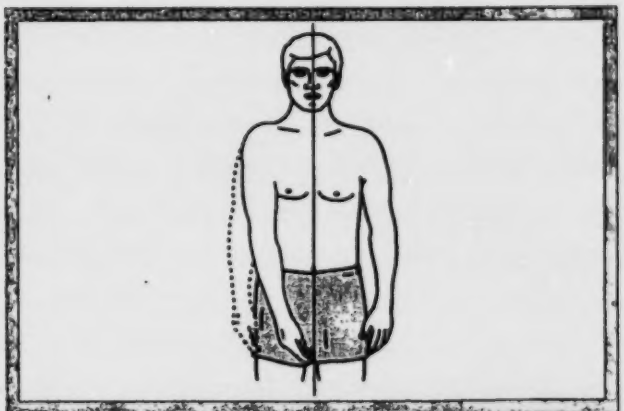

Figure 8
Adduction of the arm

Figure 9
Flexion of the arm at the elbow

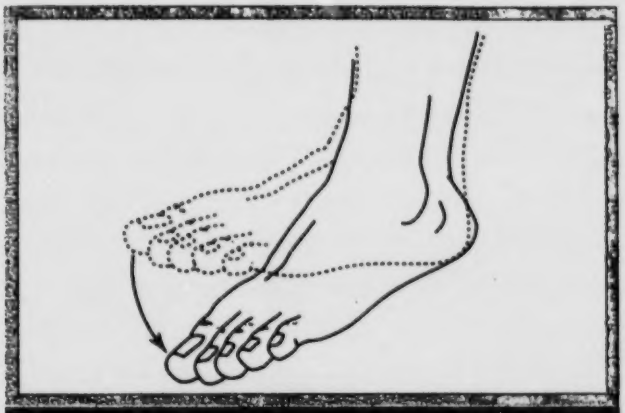

Figure 10
Plantar flexion

Figure 11
Extension of the arm at the elbow

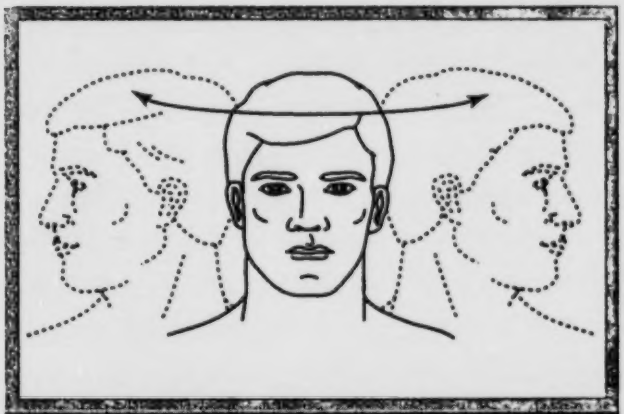

Figure 12
Medial rotation of the head

8. **Protractor** (pro-trak´-tuhr)—Performs protraction, moving a part forward
9. **Retractor** (ri-trak´-tuhr)—Performs retraction, moving a part back
10. **Invertor** (in-vuhrt´-uhr)—Performs inversion, turning a part upside down or inside out
11. **Evertor** (i-vuhrt´-uhr)—Performs eversion, turning or rotating a part outward
12. **Supinator** (su-puh-nat´-uhr)—Performs supination, turning a part upward

    Example: Supination of the hand (see Figure 13 on the next page)
13. **Pronator** (pro-nat´-uhr)—Performs pronation, turning a part downward

    Example: Pronation of the hand (see Figure 14 on the next page)

14. **Dorsiflexor** (dor´-si-flek-suhr)—Performs dorsiflexion, moving a part toward the back

    Example: Dorsiflexion of the foot (see Figure 15)

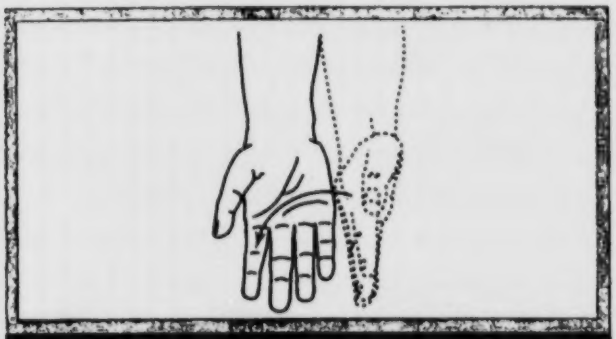

Figure 13
Supination of the hand

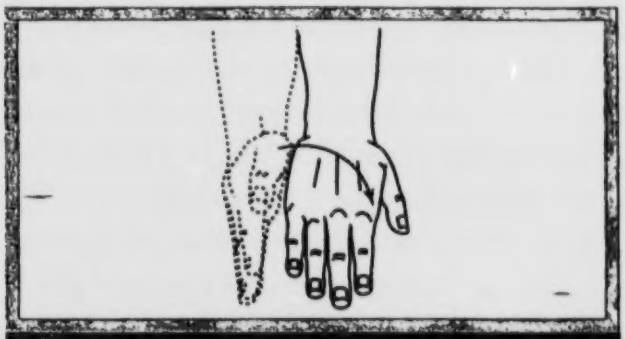

Figure 14
Pronation of the hand

Figure 15
Dorsiflexion of the foot

15. **Sphincter** (sfink´-tuhr)—Performs constriction, closing a body opening

    ✔ **NOTE:** A sphincter is a circular muscle associated with body passages that open and close to regulate the movement of materials. Examples include the urethral sphincter of the urinary tract and the pyloric sphincter of the stomach.

16. **Tensor** (ten´-suhr)—Performs tension, making a part more rigid

    ✔ **NOTE:** A tensor or groups of tensors are often associated with joints, such as the knees. They help to hold the joint in a fixed position, providing additional strength. This type of muscle is also referred to as a *fixator muscle*.

OBJECTIVE 10

Define terms that describe how muscles function during coordinated movement.

1. **Prime-mover muscle**—A muscle that generates the majority of force to accomplish a movement

   ✔ **NOTE:** Generally, other muscles also assist the prime mover in performing the action.

2. **Agonist** (ag´-uh-nuhst)—A muscle or group of muscles that create a specific movement by flexing

3. **Antagonist** (an-tag´-uh-nuhst)—A muscle or group of muscles that, when flexed, directly oppose prime-mover muscles

4. **Synergist** (sin´-uhr-jest)—A muscle or group of muscles that assist in the movement produced by prime-mover muscles

5. **Fixator** (fik´-sat-uhr)—A muscle or group of muscles that stabilize a joint, helping to maintain posture and balance during the action of prime-mover muscles

OBJECTIVE 11

State the functions of the major muscle groups.

1. **Head and face muscles**—Control talking, chewing, swallowing, facial expressions, and blinking

2. **Neck muscles**—Move the head from side to side, from front to back, and in rotation

3. **Back muscles**—Allow the body to bend, turn, and stand erect

4. **Chest muscles**—Assist in respiration and movements of the neck, arms, and trunk

5. **Abdominal muscles**—Support the internal organs, assist in respiration, and assist in eliminating waste from the large intestine and bladder

6. **Perineal** (per-uh-ne´-uhl) **muscles**—Assist in defecation and urination and form the floor of the pelvic cavity

OBJECTIVE 12

State the functions of the major muscles of the neck, head, and face (see Figure 16 on page 19).

✔ **NOTE:** The names of muscles can appear somewhat overwhelming at first, as many of them still use Latin forms. However, most of the names of the muscles are actually descriptive of their location, shape, associated body part, orientation on the body (anterior, dorsal, oblique, etc.), and function. In most cases, not all of these characteristics are part of a muscle's name, but knowing that these features contribute to the naming of muscles should help you figure out how many of the names apply to which muscles. For example, one of the muscles of the forearm is called the *extensor carpi radialis longus*. This name tells you that the muscle is an extensor and, thus, it extends a body part at a joint. *Carpi* refers to the carpals or bones of the wrist. This particular muscle is attached to the radius bone. There is also an extensor carpi ulnaris that is attached to the ulna. The term *longus* is Latin for long, indicating that this muscle is long in comparison to another similar muscle. In this case, the similar muscle is the *extensor carpi radialis brevis* with the Latin word *brevis* meaning short, as in *brief* and *brevity*. As you work with the names of muscles, this system of naming will become more familiar to you and easier to understand.

1. **Frontalis** (fruhn-tal´-is)—Wrinkles the forehead horizontally

   ✔ **NOTE:** The frontalis is also referred to as the *occipto frontalis* (awk-si´-puh-tuhl fruhn-tal´-is).

2. **Temporalis** (tem-puh-ral´-is)—Closes the mandible

3. **Orbicularis oculi** (or-bik´-yuh-luhr-is awk´-yuh-li)—Closes the eyelids

4. **Orbicularis oris** (or´-is)—Draws the lips together as in kissing

5. **Buccinator** (buk´-sin-a-tuhr)—Moves the lips for blowing, whistling, and smiling

6. **Masseter** (muh-set´-uhr)—Closes the jaws as in chewing

7. **Trapezius** (truh-pe´-ze-us)—Moves the shoulders by raising, assists in moving the head to one side or the other, hyperextends the head when the occiput acts as insertion, and helps hold the head erect

   ✔ **NOTE:** The trapezius is trapezoidal, with the narrow end attached to the clavicle and scapula and the wide end spreading from the occiput along the vertebral column, over the scapula, and to the thoracic vertebrae. Thus, the trapezius is part of the neck, shoulders, and back.

8. **Sternocleidomastoid** (stuhr-no-kli´-do-mas-toid)—Rotates the head from side to side, flexes the upper vertebral column and head as in bowing the head, and helps hold the head erect

   ✔ **NOTE:** There is a sternocleidomastoid muscle along each side of the neck, extending from the sternum to the mastoid process of the temporal bone in the skull.

9. **Platysma** (pluh-tiz´-muh)—Acts to wrinkle the skin in the neck and depresses the mandible

KEY TERMS

Hyperextend (hi-puhr-ik-stend´)—To extend to its fullest range of motion or beyond

Occiput (awk´-suh-puht)—The back of the head

Clavicle (klav´-i-kuhl)—The collarbone

Scapula (skap´-yuh-luh)—The shoulder blade

Sternum (stuhr´-nuhm)—The breastbone

Mastoid (mas´-toid) **process**—The process of the temporal bone behind the ear

Mandible (man´-duh-buhl)—The lower jawbone

OBJECTIVE 13 | **Label the major muscles of the neck, head, and face** (see Figure 16).

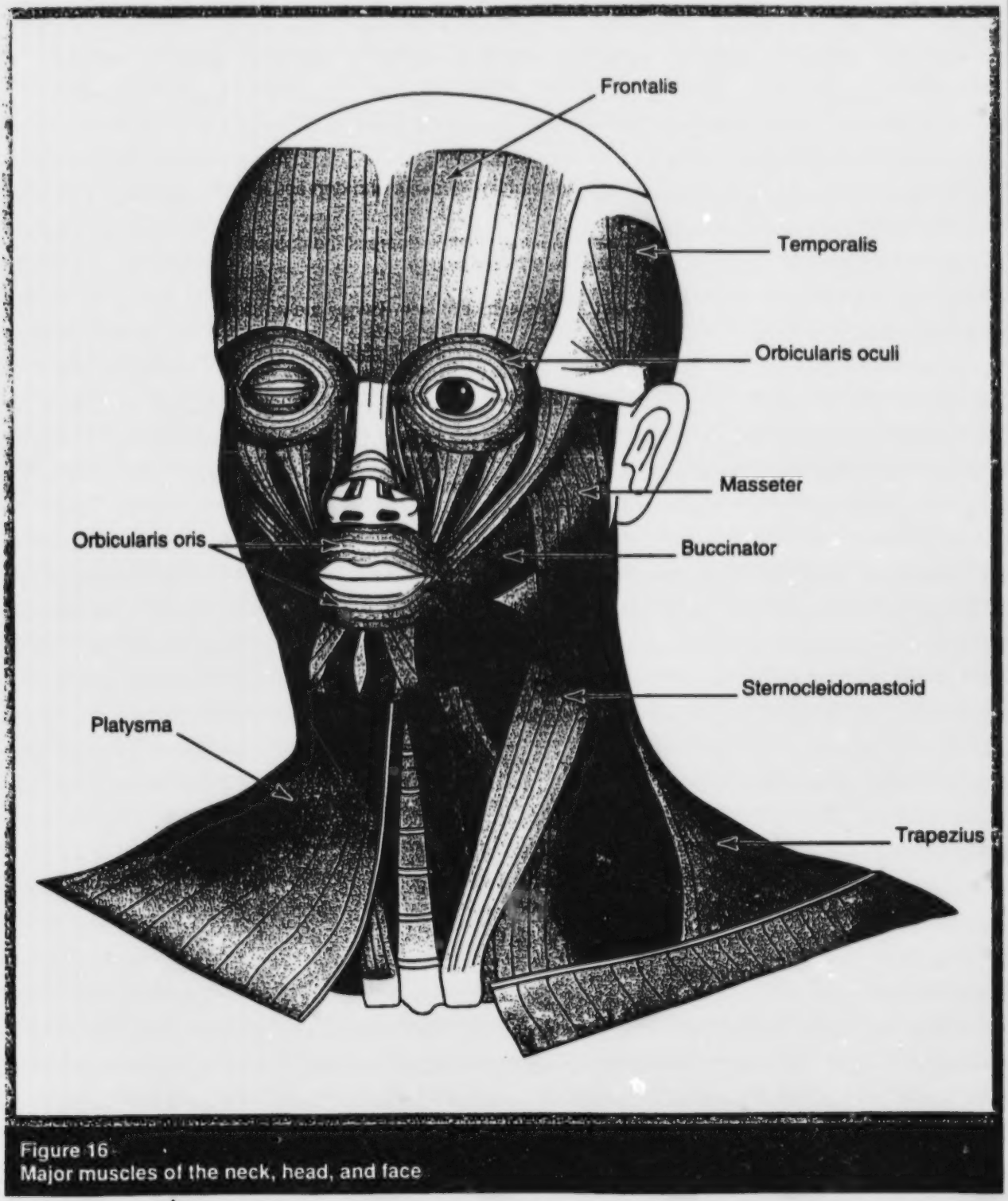

Figure 16
Major muscles of the neck, head, and face

OBJECTIVE 14

State the functions of the major muscles of the torso (see Figure 17 on the next page).

1. **Deltoid** (del´-toid)—Moves the upper arm at the point of the shoulder
2. **Pectoralis** (pek´-tuh-ra-lis) **major**—Flexes the upper arm, adducts the upper arm anteriorly, and draws the arm across the chest
3. **Serratus** (suh-ra´-tuhs) **anterior**—Rotates the scapula and raises the shoulder, as in full flexion and abduction of the arm
4. **Intercostals** (in-tuhr-kos´-tuhls)—Elevate and depress the ribs

   ✔ **NOTE:** The internal intercostals depress the ribs while the external intercostals elevate the ribs to assist with breathing.
5. **Latissimus dorsi** (la-tis´-i-muhs dor´-si)—Brings the arms down forcefully
6. **Diaphragm** (di´-uh-fram)—Contracts and relaxes to cause inhalation and exhalation
7. **External oblique**—Compresses the abdomen and rotates the trunk laterally
8. **Internal oblique**—Compresses the abdomen and rotates the trunk laterally
9. **Transversus abdominis** (trans-vur´-suhs ab-dawm´-uhn-is)—Compresses the abdomen and rotates the trunk laterally
10. **Rectus** (rek´-tuhs) **abdominis**—Compresses the abdomen and rotates the trunk laterally and flexes the trunk

    ✔ **NOTE:** The abdominal muscles assist with defecation, childbirth, and forced expiration.
11. **Levator ani** (li-vat´-uhr a´-ni)—Forms the floor of the pelvic cavity and supports the organs
12. **Deep transverse perinei** (per-uh-ne´-i)—Forms the floor of the pelvic cavity

OBJECTIVE 15 | **Label the major muscles of the torso** (see Figure 17).

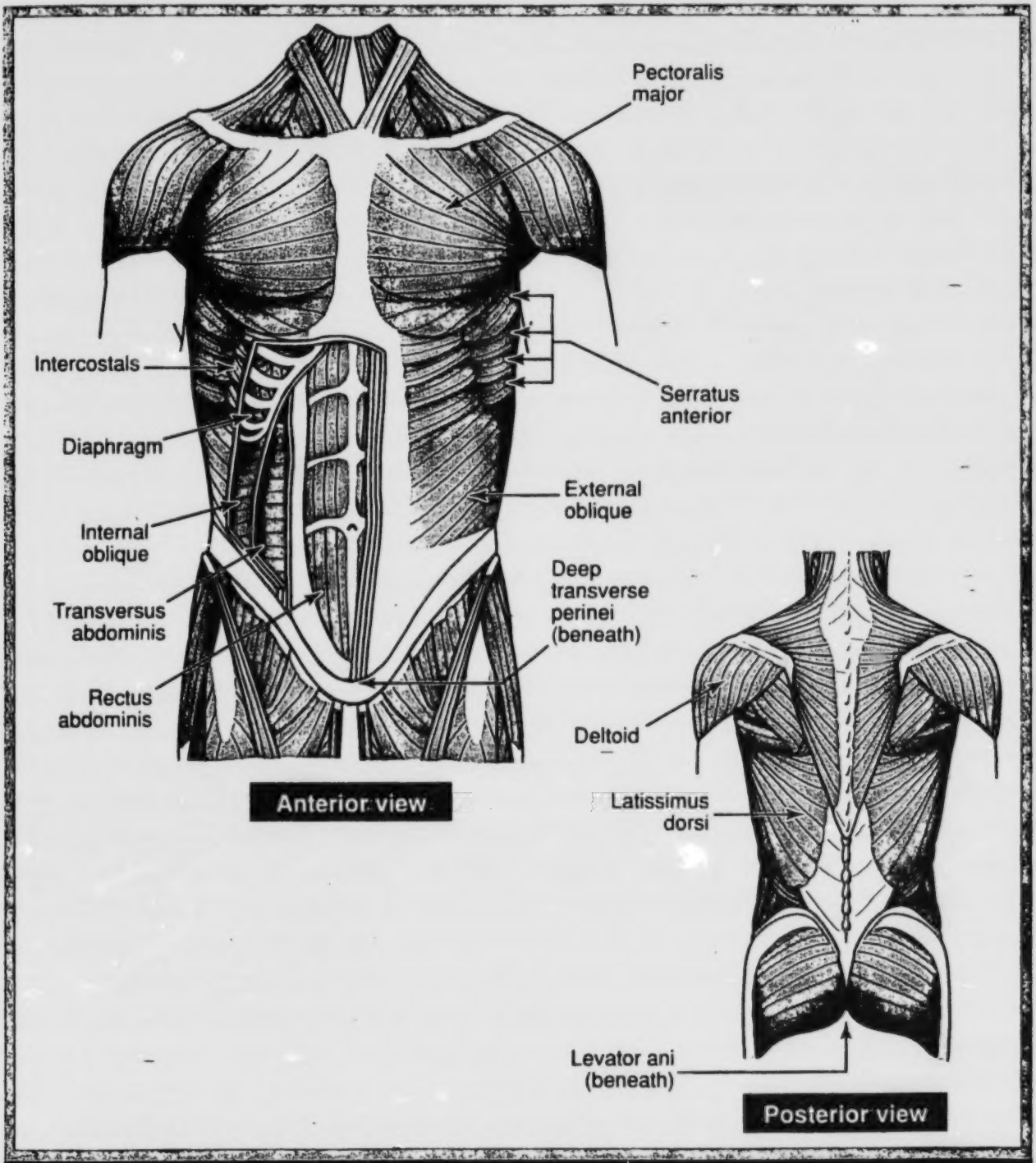

Figure 17
Major muscles of the torso

OBJECTIVE 16

State the functions of the major muscles of the arms (see Figure 18 on the next page).

1. **Biceps brachii** (bi´-seps bra´-ke-i)—Flexes the supinated forearm

   ✔ **NOTE:** One of the ways in which muscle names refer to the shapes of muscles is by describing how they are divided into sections. Thus, biceps have two sections, triceps have three sections, quadriceps have four sections, etc.

2. **Triceps** (tri´-seps) **brachii**—Extends the lower arm
3. **Brachialis** (bra´-ke-al-is)—Flexes the pronated forearm
4. **Brachioradialis** (bra´-ke-o-ra-de-al-is)—Flexes the forearm
5. **Carpi** (kawr´-pi) **muscles**—Control hand movements
6. **Digitorum** (dij´-uh-tor-um) **muscles**—Control finger movements
7. **Pollicis** (pawl´-uh-cis) **muscles**—Control thumb movements

OBJECTIVE 17 | **Label the major muscles of the arms** (see Figure 18).

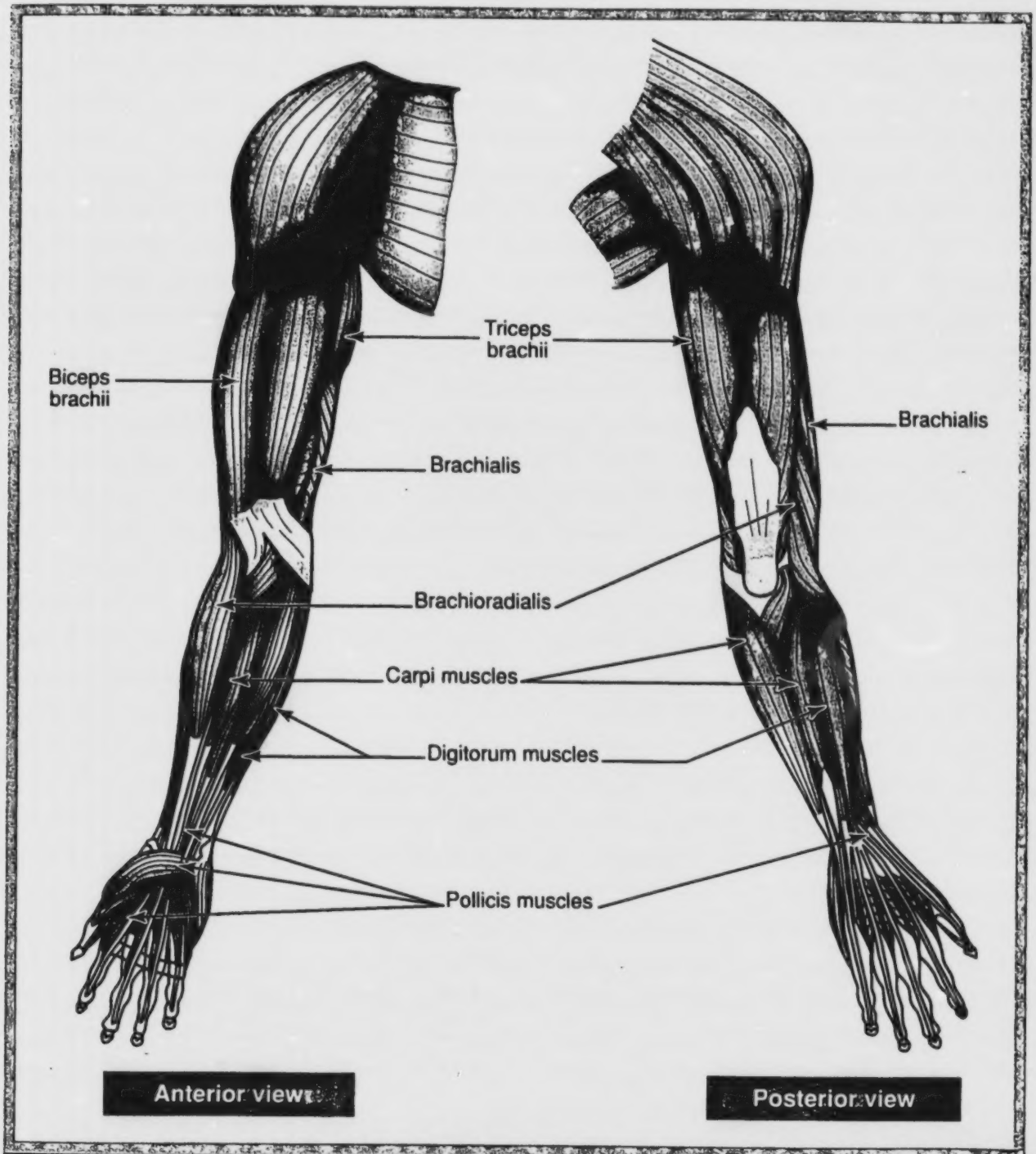

Figure 18.
Major muscles of the arms.

OBJECTIVE 18

State the functions of the major muscles of the legs (see Figure 19 on the next page).

✔ **NOTE:** The muscles of the upper leg extend to the hips for attachment. Thus, the muscles of the hips and buttocks are included.

1. **Gluteus** (glut´-e-uhs) **maximus**—Helps maintain an erect posture and extends and rotates the thigh
2. **Gluteus medius**—Abducts the thigh, rotates the thigh outward, and stabilizes the pelvis on the femur
3. **Gluteus minimus**— Abducts the thigh, rotates the thigh outward, stabilizes the pelvis on the femur, and extends the thigh
4. **Sartorius** (sawr´-tor-e-uhs)—Adducts and flexes the leg
5. **Quadriceps femoris** (kwad´-ruh-seps fem´-uh-ris)—Extends the leg
6. **Adductor**—Presses the thighs together
7. **Hamstring**—Flexes the lower leg
8. **Gastrocnemius** (gas-tro´-kne-me-uhs)—Extends the foot
9. **Tibialis** (tib-e-a´-lis) **anterior**—Flexes the foot and inverts the ankle
10. **Peroneus** (per-uh-ne´-uhs) **longus**—Everts the ankle
11. **Soleus** (so´-le-uhs)—Inverts the ankle
12. **Flexor digitorum** (dij´-uh-tor-uhm)—Flexes the toes
13. **Extensor digitorum**—Extends the toes

OBJECTIVE 19 | **Label the major muscles of the legs** (see Figure 19).

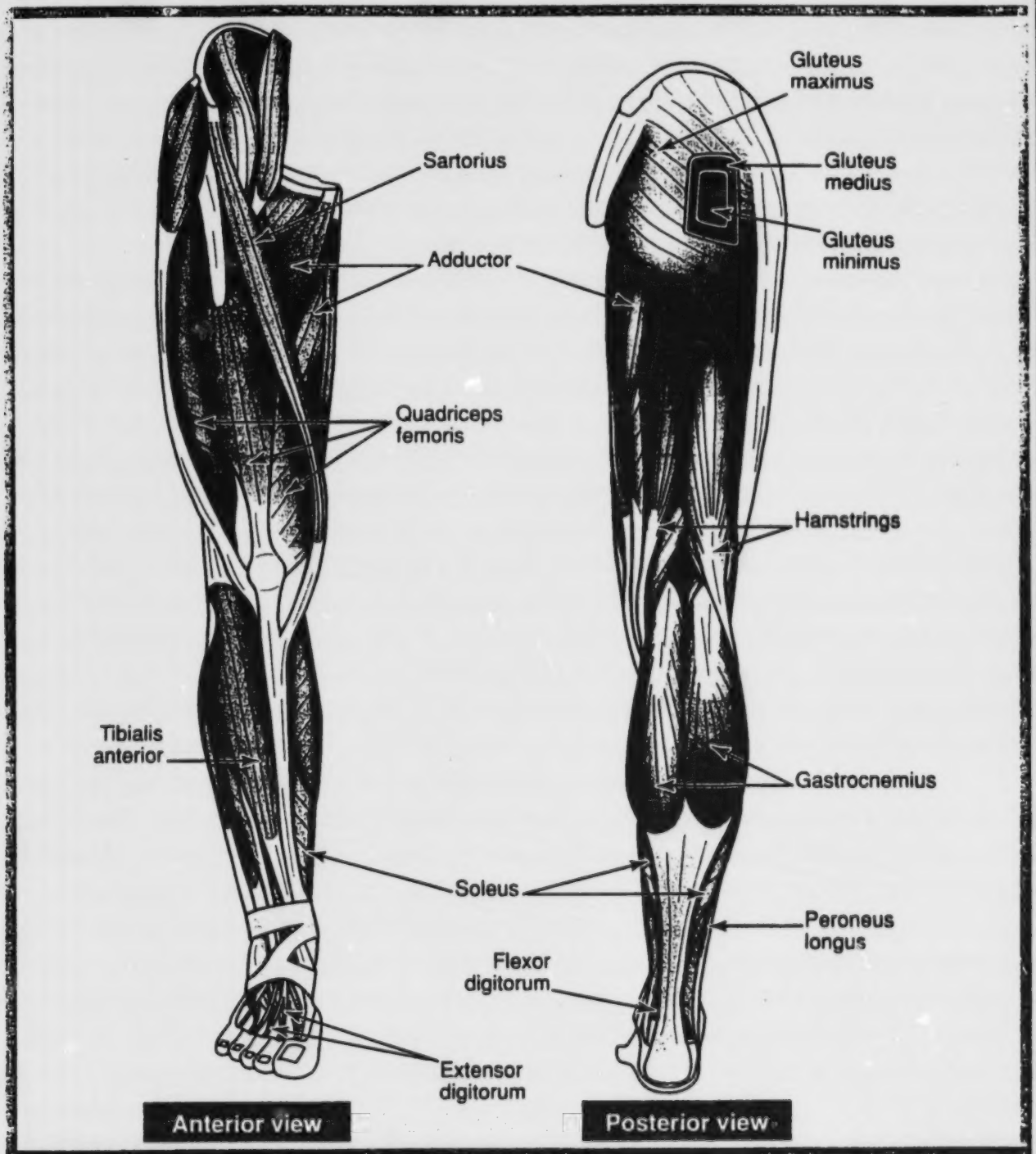

Figure 19
Major muscles of the legs

OBJECTIVE 20

Match common disorders and abnormalities of the muscular system to their correct definitions.

1. **Tenosynovitis** (ten-o-sin-uh-vi´-tis)—An inflammation of the tendon sheath often caused by repetitive motion
2. **Atrophy** (a´-truh-fe)—A condition of weakness in a muscle due to lack of use
3. **Cramps** (kramps´)—Painful, involuntary twitches of a muscle
4. **Convulsions** (kuhn-vuhl´-shuns)—Abnormal, uncoordinated contractions of muscles
5. **Fibrillation** (fib-ruh-la´-shuhn)—An **asynchronous contraction** of individual tissue fibers within a muscle

   ✔ **NOTE:** Because the muscles usually work in pairs or groups, fibrillation may cause uncoordinated movements. Fibrillation in a single muscle may appear as spasms. Fibrillation of cardiac muscle can be very serious and can even lead to death.

KEY TERM

Asynchronous (a-sin´-kruh-nuhs) **contraction**—The flexing of the muscles at unexpected or undesired times

6. **Strain** (stran´)—A condition in which the muscle fibers have been overstretched or torn
7. **Myositis** (mi-uh-sit´-uhs)—An inflammation of muscle tissue
8. **Fibromyositis** (fi-bro-mi-uh-sit´-uhs)—An inflammation of a tendon
9. **Contusion** (kuhn-tu´-zhuhn)—Localized internal bleeding within a muscle
10. **Myalgia** (mi-al´-juh)—Muscle pain
11. **Muscular dystrophy** (dis´-truh-fe)—A group of genetic diseases that lead to atrophy of the skeletal muscles
12. **Myasthenia gravis** (mi-uhs-the´-ne-uh grav´-uhs)—An autoimmune disease in which the immune system attacks muscle cells at the neuromuscular junction
13. **Hernia** (huhr-ne´-uh)—A protrusion of an abdominal organ, such as the small intestine, due to a weakness in the abdominal muscles
14. **Tetanus** (tet´-nuhs)—The inability of the muscles to relax due to the presence of a toxin
15. **Botulism** (bawch´-uh-liz-uhm)—An infection by an organism that releases a toxin that prevents muscle contraction

OBJECTIVE 21

Assignment Sheet 1—Practice Critical Thinking: Determine Common Intramuscular Injection Sites

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Presentation followed agreed-upon format	_____
• Presentation met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

Many drugs and vaccines are given by means of injections into large muscles in a procedure called *intramuscular injections*. The muscles most commonly used for intramuscular injections are the deltoid at the junction of the shoulder and the upper arm, the gluteus medius of the buttock, and the **vastus lateralis** muscle of the thigh. The decision of where to make an injection depends on a number of factors, such as the type of drug, the age of the patient, and other medical considerations.

KEY TERM

Vastus (vas´-tuhs) **lateralis**—The largest of the four muscles of the quadriceps femoris, situated on the lateral side of the thigh

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Study the report forms provided on page 29.

_____ 3. Arrange with your instructor to observe a physician or group of physicians for a period of time to be determined by your instructor.

_____ 4. Make additional copies of the report forms on page 29.

_____ 5. Complete a report form for each injection you observe during the observation period.

_____ 6. Review your report forms and draw conclusions concerning the intramuscular injection sites most commonly used by patient age group.

_____ 7. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in presenting your observation-findings report to your class. Describe that format on the blanks provided below.

_____ 8. Check with your instructor to agree upon the criteria he or she will use to evaluate your report. Describe those criteria on the blank lines below.

_____ 9. Complete your report and turn in your report and your report forms to your instructor for evaluation.

Format of report _____

_____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

_____

Report Form

Date: _____ Sex/age of patient: _____

Drug used: _____

Site of injection: _____

_____

Other medical considerations: _____

_____

Physician: _____

Report Form

Date: _____ Sex/age of patient: _____

Drug used: _____

Site of injection: _____

_____

Other medical considerations: _____

_____

Physician: _____

Report Form

Date: _____ Sex/age of patient: _____

Drug used: _____

Site of injection: _____

_____

Other medical considerations: _____

_____

Physician: _____

OBJECTIVE 22

Assignment Sheet 2—Practice Critical Thinking: Report on Disorders and Abnormalities of the Muscular System

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Presentation followed agreed-upon format	_____
• Presentation met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

A number of conditions can affect the muscular system, ranging from physical injuries to disease to reactions to toxins. Additionally, these conditions can affect the skeletal system and the articular structures because of their intimate involvement with the muscular system.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Study the report form provided on page 33.

_____ 3. Check with your instructor to determine which of the following disorders or abnormalities you will investigate for your report. Indicate the topic or topics of your report on the blanks lines provided on the next page.

- carpal-tunnel syndrome
- myasthenia gravis
- muscular dystrophy
- tetanus
- botulism
- the use of anabolic steroids
- hernia

_____ 4. Check with your instructor to determine the format (written report, PowerPoint presenation, poster, etc.) your instructor wants you to follow in presenting your report. Describe that format on the blank lines provided below.

_____ 5. Check with your instructor to agree upon the criteria he or she will use to evaluate your report presentation. Describe those criteria on the blank lines provided below.

_____ 6. Make additional copies of the report form on the next page.

_____ 7. Complete a form for each disorder or abnormality you have been assigned.

_____ 8. Review your forms, complete your report, and return your forms and your report to your instructor for evaluation.

Topic or topics assigned _____

_____

_____

_____

_____

_____

Format of report _____

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Evaluation criteria _____

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Report Form

Condition:

Symptoms:

Contributing causes:

Complications:

Treatments, including surgical interventions:

MODULE SET II:
Major Body Systems

Module 4: Nervous System

1109

Module Contents

Components		Page
	Learning Activities Sheet	3
	Module Objective Sheet	5
	Information Sheet	7
	Assignment Sheet	
	1—Practice Critical Thinking: Investigate Nerve-Block Anesthetics	37

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 40.
- ❑ 5. **Research** Online resources to learn more about the nervous system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Investigate Nerve-Block Anesthetics."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the nervous system, state the functions of the major structures of the nervous system, and define common disorders and abnormalities of the nervous system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *nervous system.*
2. State the functions of the nervous system.
3. Describe the major subsystems of the nervous system.
4. Describe the major subsystems of the peripheral nervous system.
5. Describe the major subsystems of the autonomic nervous system.
6. Define the term *nerve tissue.*
7. Define the basic types of nerve tissue.
8. State the functions of the major structures of a neuron.
9. Label the major structures of a neuron.
10. Define the term *nerve fiber.*
11. Define the major structures of a nerve fiber.
12. Label the major structures of a nerve fiber.
13. Match types of neurons to their correct descriptions.
14. Complete statements that describe the transmission of nerve impulses.
15. Complete statements that describe a reflex arc.
16. Label the major structures of a reflex arc.
17. Describe the stages in the regeneration of a peripheral nerve.
18. State the functions of the types of neuroglia.
19. List the major structures within the spinal canal.
20. Complete statements that describe the structure and functioning of the spinal cord.

21. State the function of cerebrospinal fluid.
22. List the components of cerebrospinal fluid.
23. Define the major structures of the meninges.
24. Define the primary divisions of the brain.
25. Label the primary divisions of the brain.
26. Define the major structures of the forebrain and the hindbrain.
27. Label the major structures of the forebrain and the hindbrain.
28. Define the terms *hemisphere*, *sulcus*, *fissure*, *lobe*, and *ventricle*.
29. Define the lobes of the cerebrum.
30. Define the fissures of the cerebrum.
31. Label the visible lobes and fissures of the cerebrum.
32. Label the functional areas of the brain.
33. Complete statements that describe the structure and functioning of the ventricles of the brain.
34. Label the ventricles of the brain and the horns of the lateral ventricles.
35. State the number and functions of the cranial nerves of the peripheral nervous system.
36. Define the term *plexus*.
37. Label the plexuses of the spinal cord.
38. Describe the number and origin of the spinal nerves.
39. List the major nerves that arise from each plexus.
40. Match common disorders and abnormalities of the nervous system to their correct definitions.
41. Practice critical thinking: investigate nerve-block anesthetics. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *nervous system.*

- **Nervous** (nuhr´-vuhs) **system**—The extensive intricate network of structures that activates, coordinates, and controls all of the functions of the body (see Figure 1)

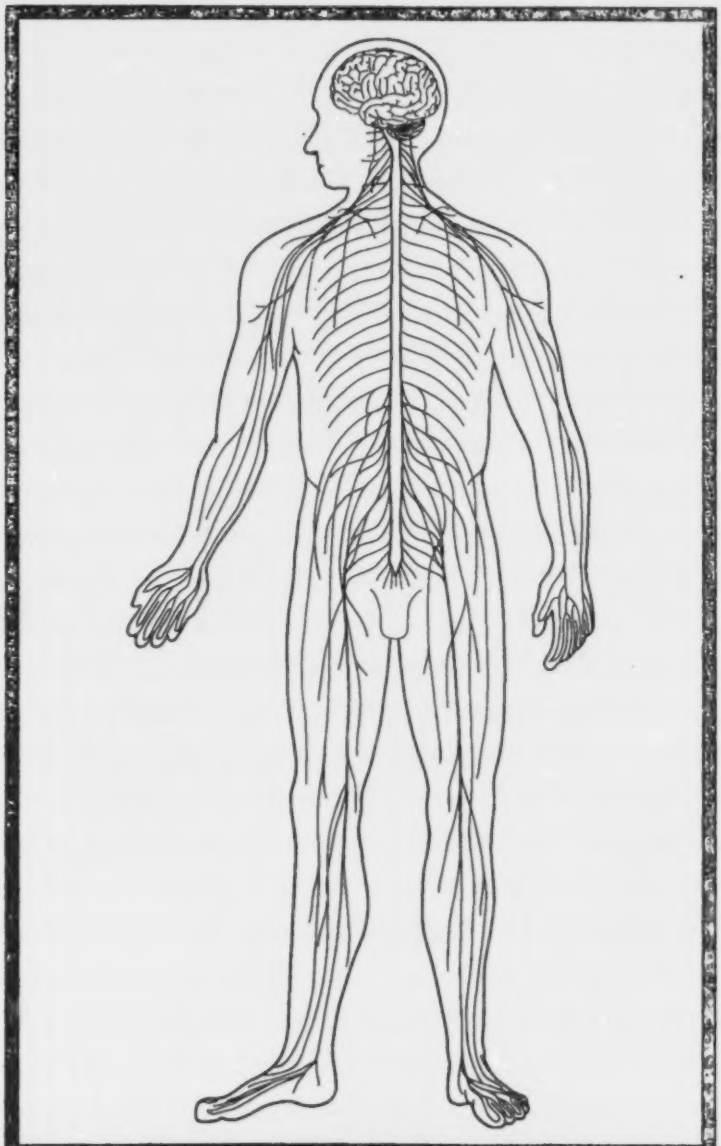


Figure 1.
Nervous system

OBJECTIVE 2

State the functions of the nervous system.

1. **Receives internal and external stimuli through the sensory organs**

KEY TERMS

Stimulus (stim´-yuh-luhs)—A change in an organism's external environment or internal conditions that cause a response in one or more of the organism's systems

✔ **NOTE:** Changes in the external environment include factors such as temperature, light levels, noises, odors, conditions that cause pain, etc. Changes in the internal environment include conditions such as being short of breath, needing an increased flow of blood, pain in the joints and internal organs, hunger, thirst, infection, and many other factors.

Sensory organ—An organ with the primary purpose of monitoring conditions in the environment and within the body in order to provide the brain with information that may require a response

✔ **NOTE:** Sensory organs include the eyes, ears, taste buds, nerve endings in the skin that sense touch and other conditions, and receptors in the nasal passages that detect odors. Information about the special sensory organs is presented in Module 6, "Special Senses," in this module set. Sensory organs are specialized extensions of the nervous system.

2. **Transmits messages to and from the brain**

✔ **NOTE:** See the key-term box with Objective 3 on the next page for the definition of the term *brain*.

3. **Interprets the transmitted messages, stores any needed information, and coordinates any required responses**

✔ **NOTE:** The brain is part of the nervous system and performs the functions related to processing messages, storing memories, and initiating responses in the body, both voluntary and involuntary.

4. **Responds to internal and external stimuli through the motor organs**

KEY TERM

Motor organ—An organ with the primary function of moving materials within the body or parts of the body itself

✔ **NOTE:** The skeletal system and muscular system are primarily responsible for moving the parts of the body. The circulatory system moves blood and the materials it carries, the digestive system moves food and nutrients, the respiratory system moves gases and water vapor, and so on with the other systems of the body that are composed of motor organs.

OBJECTIVE 3

Describe the major subsystems of the nervous system (see Figure 2 below).

1. **Central nervous system (CNS)**—The part of the nervous system that consists of the **brain** and **spinal cord**, to which sensory impulses are transmitted and from which motor impulses pass out; the part of the nervous system that coordinates the activity of the entire nervous system

2. **Peripheral nervous system (PNS)**—The part of the nervous system that is outside the central nervous system and consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves that link the various parts of the body to the central nervous system

KEY TERMS

Brain –The portion of the central nervous system contained within the cranium and containing specialized cells that coordinate and regulate the functions of the central nervous system

Spinal cord –The cord of nerve tissue that extends from the brain lengthwise along the back in the **spinal canal** and gives off pairs of spinal nerves, carries impulses to and from the brain, and serves as a center for initiating and coordinating reflex acts

Spinal canal –The row of aligned holes in the vertebrae through which the spinal cord passes

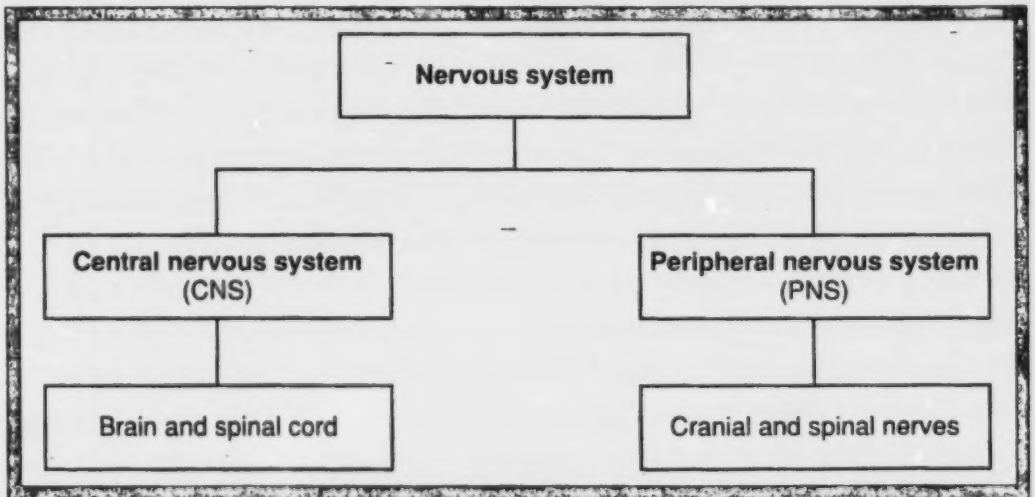


Figure 2
Major subsystems of the nervous system

OBJECTIVE 4

Describe the major subsystems of the peripheral nervous system (PNS) (see Figure 3 on the next page).

1. **Somatic nervous system (SNS)**—The part of the peripheral nervous system that connects the central nervous system to the skin and the skeletal muscles via the cranial and spinal nerves and initiates voluntary responses

2. **Autonomic nervous system (ANS)**—The part of the peripheral nervous system that connects the central nervous system to the visceral organs via the cranial and spinal nerves and initiates involuntary responses

KEY TERMS

Somatic (so´-ma-tik)—Of, relating to, or affecting the body

Autonomic (o-tuh-naw´-mik)—Acting or occurring involuntarily

OBJECTIVE 5

Describe the major subsystems of the autonomic nervous system (ANS) (see Figure 3 below).

1. **Sympathetic** (sim-puh-the´-tik) **nervous system**—The part of the autonomic nervous system that prepares the body to deal with emergencies through the expenditures of energy

2. **Parasympathetic** (par-uh-sim-puh-the´-tik) **nervous system**—The part of the autonomic nervous system that restores homeostatic balance and conserves energy

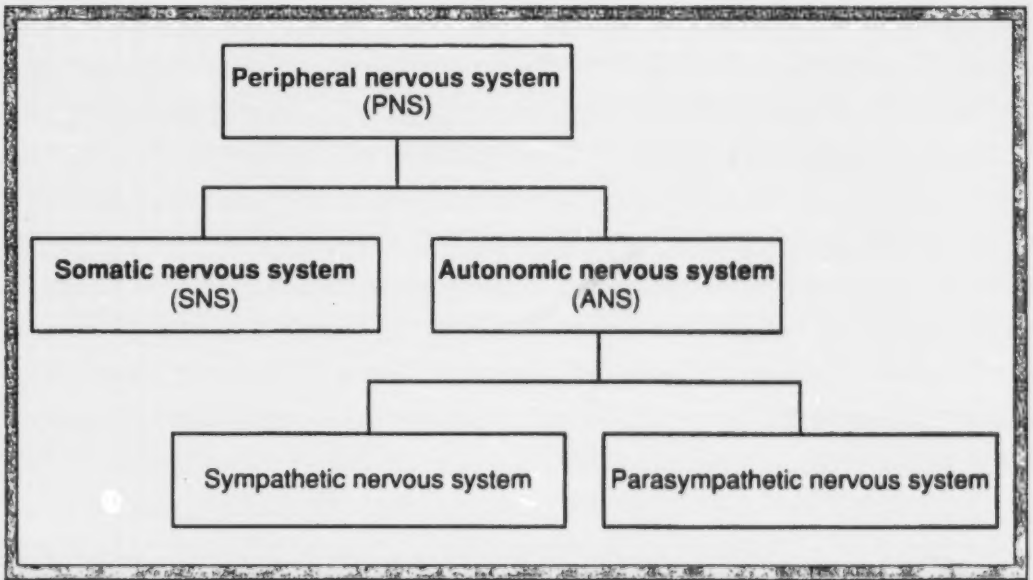


Figure 3
Major subsystems of the peripheral nervous system

OBJECTIVE 6

Define the term *nerve tissue*.

- **Nerve tissue**—Tissue consisting of one or more bundles of impulse-carrying fibers that connect the brain and the spinal cord with other parts of the body

OBJECTIVE 7

Define the basic types of nerve tissue.

1. **Neurons** (n{y}u´-rawns)—The basic nerve-tissue cells that are capable of transmitting nerve impulses (see Figure 4)

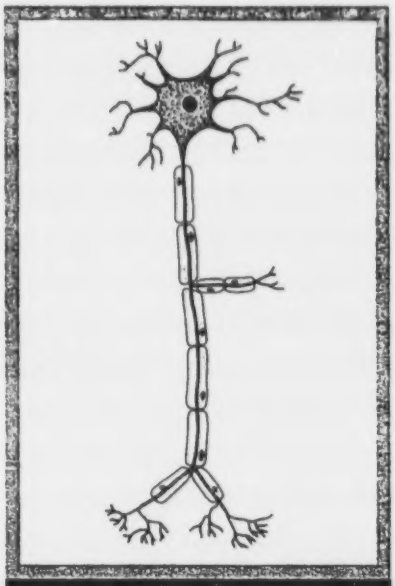


Figure 4
Neuron (sensory neuron)

2. **Neuroglia** (n{y}u-ro´-gle-uh)—The basic nerve-tissue cells that support neurons and play a role when there is injury or infection in the nervous system (see Figure 5)

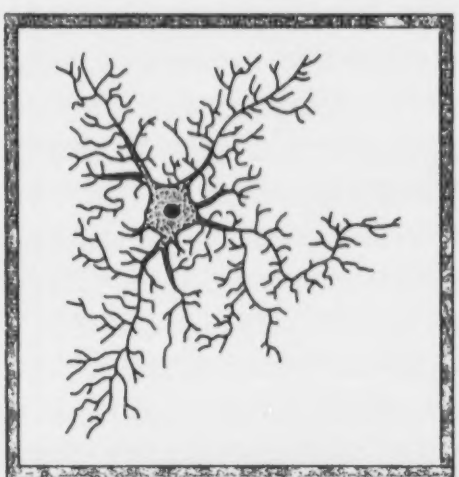


Figure 5
Neuroglia

OBJECTIVE 8

State the functions of the major structures of a neuron (see Figure 6 below).

✔ **NOTE:** Neurons consist of a cell body and two extensions: axons (ak´-sawns) and dendrites (den´-drits). A neuron will have one axon but may have several dendrites. Basically, neurons are relay stations. Nerve impulses or signals—which are essentially electrical current—enter one end of the neuron (the dendrites), are transported through the cell body, and exit the other end of the neuron (the axon). The impulse then passes through the space that separates the axon from a dendrite of another neuron and continues its journey, somewhat like a spark passing across the gap of a spark plug.

1. **Cell body**—Acts as a sending and receiving center, performs metabolic and reproductive functions for the cell, and stores energy

   ✔ **NOTE:** The cell body of a neuron is like most of cells within the body. It carries on routine cell functions such as metabolism and mitosis. It stores energy for use by the cell when additional energy is needed. The cell body of the neuron also assists with the specialized functions of a nerve cell by relaying impulses from the dendrites to the axon.

2. **Dendrite**—Carries impulses to the cell body

3. **Axon**—Carries impulses from the cell body

OBJECTIVE 9

Label the major structures of a neuron (see Figure 6).

✔ **NOTE:** The artwork in Figure 6 shows a typical motor neuron. Specific types of neurons vary in structure (see Figure 8 on page 16).

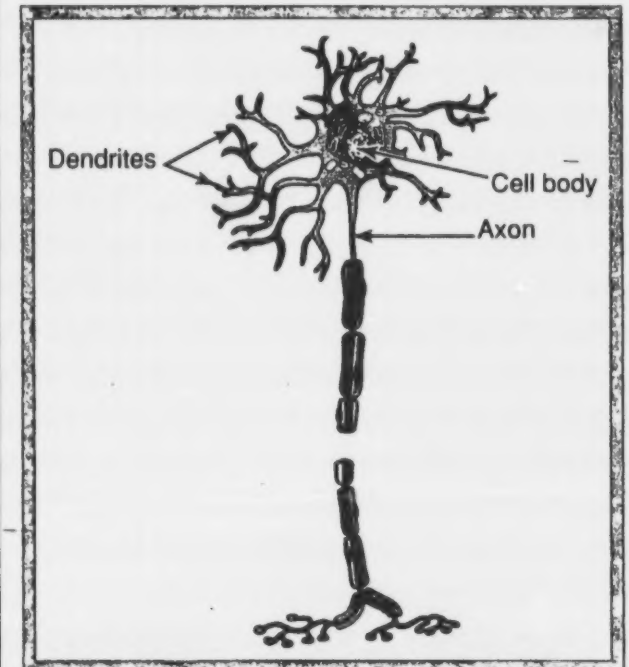


Figure 6
Major structures of a neuron

OBJECTIVE 10

Define the term *nerve fiber*.

- **Nerve fiber**—An elongated process of a neuron—usually the axon—concerned primarily with the conduction of impulses (see Figure 7 on the next page)

✔ **NOTE:** Nerve fibers form the major portion of the **white matter** of the brain and spinal cord and all nerves. Most nerve fibers in peripheral nerves are **myelinated**.

KEY TERMS

White matter—Neural tissue that consists largely of myelinated nerve fiber and has a whitish color

Myelin (mi′-uh-luhn)—A soft, white, somewhat fatty material that forms a thick sheath about the core of a myelinated nerve fiber

Myelinated (mi′-uh-luh-na-tuhd)—Having a myelin sheath

OBJECTIVE 11

Define the major structures of a nerve fiber (see Figure 7 on the next page).

1. **Axis cylinder**—The central core of a nerve fiber that consists of a jelly-like material
2. **Myelin sheath**—The segmented, fatty covering of a nerve fiber that wraps the axons of many nerves and acts as an electrical insulator that reduces the possiblity of an impulse stimulating adjacent nerves

   ✔ **NOTE:** In myelinated peripheral nerves, the sheaths are composed of Schwann cells. The myelin sheaths around the central nerve fibers are composed of oligodendroglia.
3. **Neurilemma** (noor-uh-lem′-uh)—The layer of cells composed of one or more Schwann cells that enclose the myelin sheath; the cell nucleus is a flattened oval that lies in a small depression in the myelin

   ✔ **NOTE:** The neurilemma—which may also be spelled *neurolemma*—is necessary for regeneration of nerves when they have been severed (see Objective 17).

OBJECTIVE 12

Label the major structures of a nerve fiber (see Figure 7).

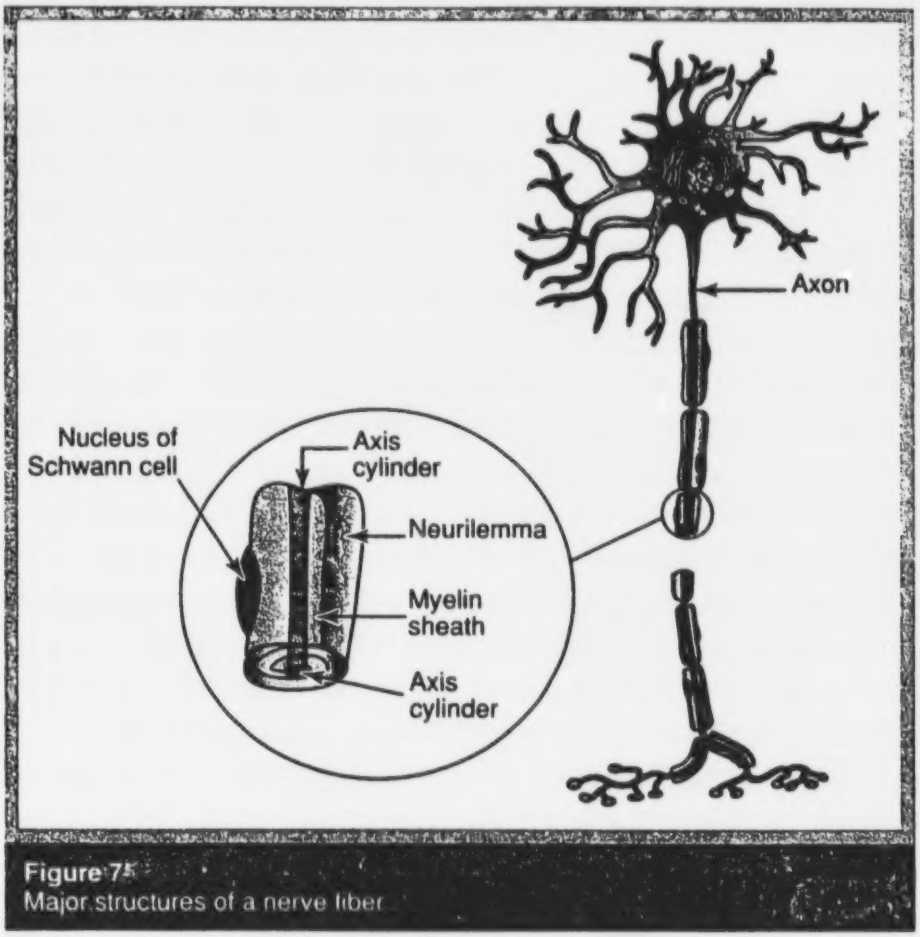


Figure 7
Major structures of a nerve fiber

OBJECTIVE 13

Match types of neurons to their correct descriptions (see Figure 8 on page 16).

✔ **NOTE:** It may already be apparent to you that there is a problem if nerve impulses travel only one way through a neuron because signals have to go to and come from the brain. If the skin receptors tell the brain that the environment is too hot, the brain must be able to send signals back to the body to address the stimulus, by sweating for example. In fact, there are parallel paths of nerves—those that transport messages to the brain from the sensory organs and those that carry messages from the brain to the motor organs.

1. **Sensory neurons**

   - Are also called *afferent* (af′-uh-ruhnt) or *receptor neurons*
   - Receive messages from all parts of the body and transmit them to the central nervous system (brain and spinal cord)

- Are controlled by the **thalamus**

KEY TERM

Thalamus (tha´-luh-muhs)—One of a pair of large oval organs in the brain

✔ **NOTE:** You will study the thalamus in Objective 26 and Objective 27.

2. Interneurons

- Are also called *central neurons* or *internuncial* (in-tuhr-nuhn´-se-uhl) *neurons* or *connecting neurons*
- Conduct messages or impulses from sensory to motor neurons
- Are found only in the central nervous system (brain and spinal cord)

3. Motor neurons

- Are also called *efferent* (ef´-uh-ruhnt) *neurons*
- Transmit messages from the central nervous system to all parts of the body
- Are located in the muscles and glands
- Are controlled by the frontal lobe of the brain

✔ **NOTE:** You will study more about the frontal lobe of the brain in Objective 29 and Objective 31.

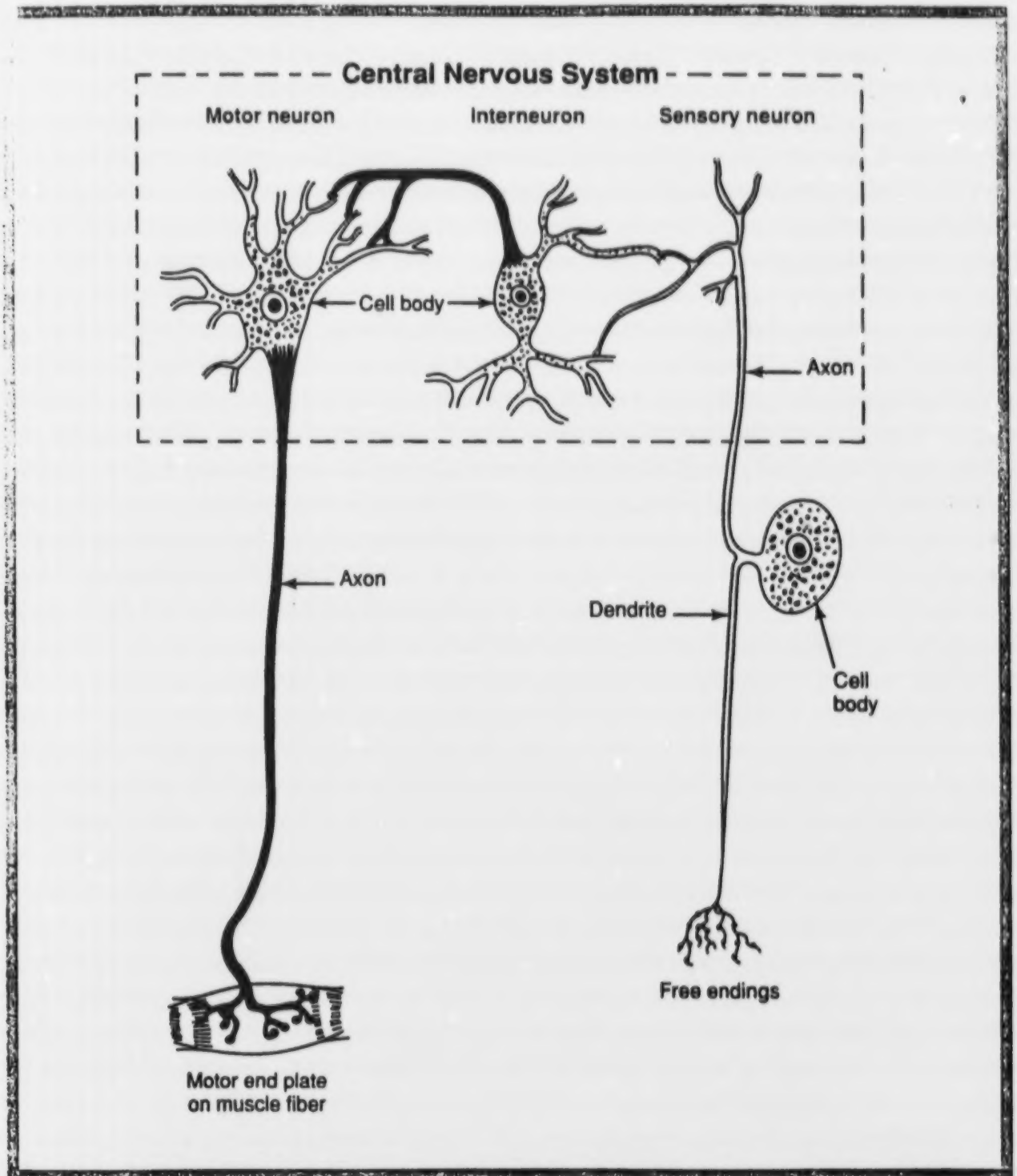


Figure 8
Types of neurons

OBJECTIVE 14

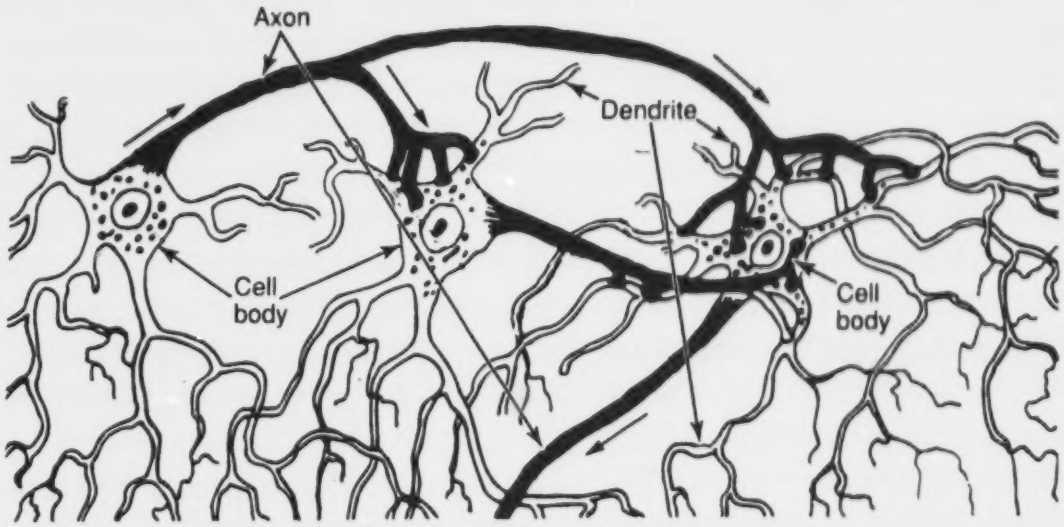
Complete statements that describe the transmission of nerve impulses (see Figure 9 below).

1. **When a neuron receives a signal, it sends an impulse on to the next neuron across the synapse between an axon and a dendrite.**
2. **Two or more neurons arranged in a chain function to conduct impulses from one place to another.**
3. **Impulses pass only in one direction from a receptor dendrite to the cell body to the axon to a dendrite and so on.**
4. **When a nerve impulse is blocked, the blocking usually takes place at a synapse.**

KEY TERMS

Synapse (sin´-aps or suh-naps´)—The space between the axon and the dendrites of adjoining neurons through which nerve impulses travel

✔ **NOTE:** There is evidence that, as nerve impulses travel over a synapse more frequently, there is less resistance to the movement of the nerve impulse. This would account for the development of skills, such as walking, talking, typing, playing a musical instrument, hitting a jump shot in basketball, and other motor activities.



Ends of axons contact dendrites or cell bodies of other cells for the transmission of impulses.

Figure 9
Transmission of nerve impulses

OBJECTIVE 15

Complete statements that describe a reflex arc.

1. **A reflex is an involuntary response to a stimulus, such as blinking the eyes when something approaches them, salivating at the sight of appetizing food, and jerking of the knee when a certain spot is tapped.**
2. **Many reflexes do not involve action on part of the brain; instead, the affector/effector circuit is completed by a loop in the spinal cord called a *reflex arc*.**
3. **A reflex arc consists of an affector** (see Figure 10 below) **that provides a signal through a sensory neuron into a spinal nerve and into the spinal cord.**
4. **The impulse passes through an interneuron in the gray matter of the spinal cord to a motor neuron that connects to an effector.**

KEY TERM

Gray matter—Nerve tissue that consists of motor neurons and interneurons

✔ **NOTE:** As you learned, some neurons have insulating sheaths that cover the axon. These sheaths are called *myelin sheaths* and such neurons are said to be *myelinated*. The neurons in gray matter do not have myelin sheaths.

OBJECTIVE 16

Label the major structures of a reflex arc (see Figure 10).

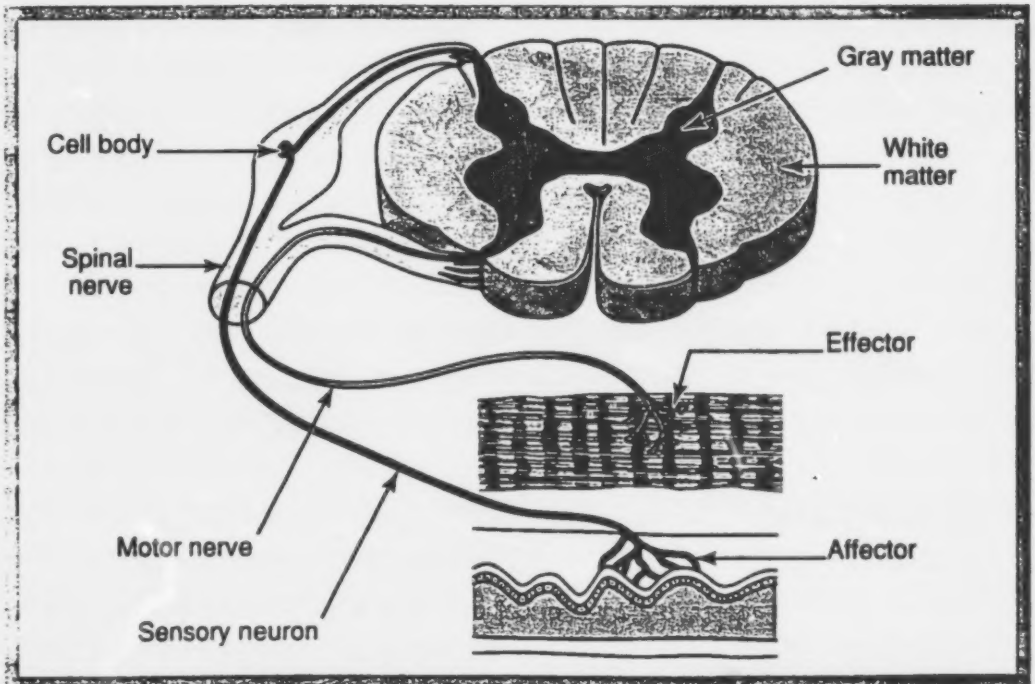


Figure 10
Major structures of a reflex arc.

OBJECTIVE 17

Describe the stages in the regeneration of a peripheral nerve.

✔ **NOTE:** Neurons cannot regenerate if the cell body is not intact, which means that they may not be capable of regeneration if the cell body is injured or attacked by disease.

1. **The part of the nerve fiber that is separated by injury or disease from the cell body disintegrates** (see Figures 11-a and 11-b below).
2. **The neurilemma starts to regenerate at the site of the injury; if the cut ends of the neurilemma are not separated by too much distance, the sections grow back together to form a neurilemmar tube** (see Figure 11-c below).
3. **The axon stump that is attached to the cell body grows into the neurilemmar tube and the regeneration is complete** (see Figure 11-d below).

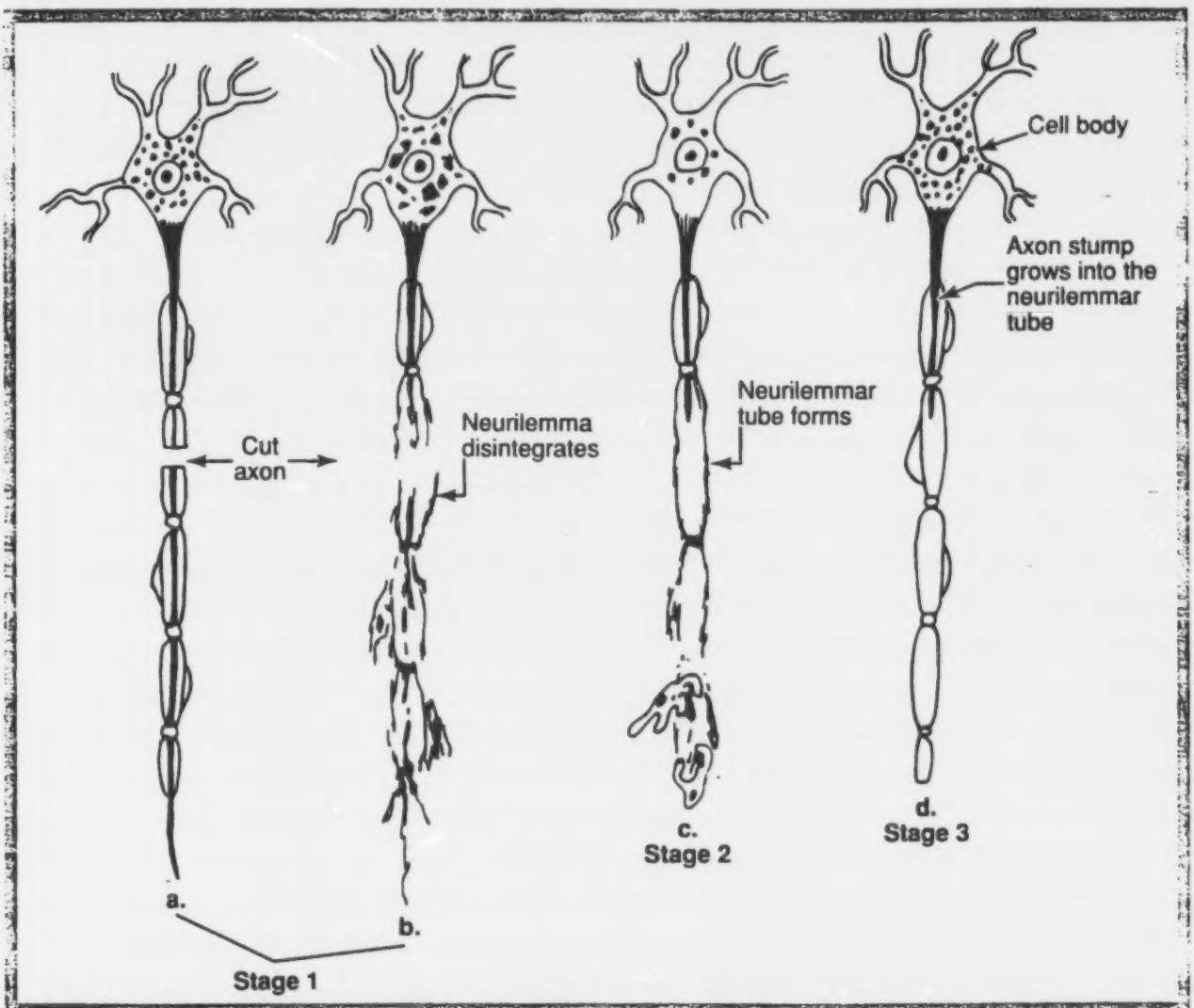


Figure 11
Stages in the regeneration of a peripheral nerve

OBJECTIVE 18

State the functions of the types of neuroglia.

1. **Oligodendrocytes** (awl-i-go-den´-druh-sits)—Form the insulating sheath of myelin on neurons in the central nervous system

   ✔ **NOTE:** Oligodendrocytes are also called *oligodendroglia.*

2. **Microglia** (mi-krawg´-li-uh)—Move so that they can locate and destroy damaged tissue and invading cells and organisms

3. **Astrocytes** (as´-truh-sits)—Prevent harmful chemicals from entering the brain from contaminated blood

   ✔ **NOTE:** Astrocytes are star-shaped neuroglia that form tight sheaths around the capillaries of the brain. The sheaths prevent large molecules from entering brain tissue.

4. **Ependyma** (ep-en´-di-muh)—Line the fluid-filled cavities in the brain and help to circulate **cerebrospinal fluid**

   ✔ **NOTE:** Ependyma are ciliated cells.

KEY TERM

Cerebrospinal fluid (suh-re-bro-spin´-uhl flu´-uhd)—The tissue fluid that circulates around the brain and spinal cord

OBJECTIVE 19

List the major structures within the spinal canal.

✔ **NOTE:** The spinal canal is a row of aligned holes in the vertebrae through which the spinal cord passes. The spinal canal provides excellent protection to this vital extension of the brain. In addition to the shielding provided by the bones of the vertebral column, the spinal cord is surrounded by a network of blood vessels and is suspended in a special fluid produced in the brain and called *cerebrospinal fluid.* The spinal canal itself is lined with special membranes called the *meninges* (muh-nin´-jez) that also extend into the cranial cavity. Further protection is provided by deposits of adipose tissue.

1. **Spinal cord**
2. **Cerebrospinal fluid**
3. **Meninges**
4. **Adipose tissue**
5. **Blood vessels**

KEY TERM

Meninx (me´-nin{k}s)—Any one of the three membranes that envelop the brain and the spinal cord

OBJECTIVE 20

Complete statements that describe the structure and functioning of the spinal cord.

1. **The spinal cord is a small cord about 18 inches (47 centimeters) long in an adult.**
2. **The spinal cord lies within the spinal canal and is surrounded by the vertebrae.**
3. **The spinal cord acts as the conduction pathway for impulses between the peripheral nerves to and from the brain.**
4. **In cross-section, the spinal cord exhibits an H-shaped area of gray matter surrounded by an outer region of white matter** (see Figure 12 below).
5. **Spinal nerves emerge from the spinal cord as two short roots—the dorsal root for the sensory nerves and the ventral root for the motor nerves** (see Figure 12 below).
6. **The spinal cord extends from the medulla of the brain to the first lumbar vertebra or top of the second lumbar vertebra, where it begins to taper into a horsetail of fibers that finally ends in the coccygeal area.**

✔ **NOTE:** At birth, the spinal cord extends the full length of the spinal column. However, bone tissue grows more rapidly than nerve tissue so that by adulthood the cord only reaches to the top of the lumbar region.

✔ **NOTE:** The term for the peripheral nerves that create the horsetail of fibers is Latin for horsetail, *cauda equina* (kaw´-duh e-kuhi-nuh).

KEY TERM

Coccygeal (kawk-si´-je-uhl)—Of or relating to the coccyx, the four fused vertebrae that form the terminus of the spinal column

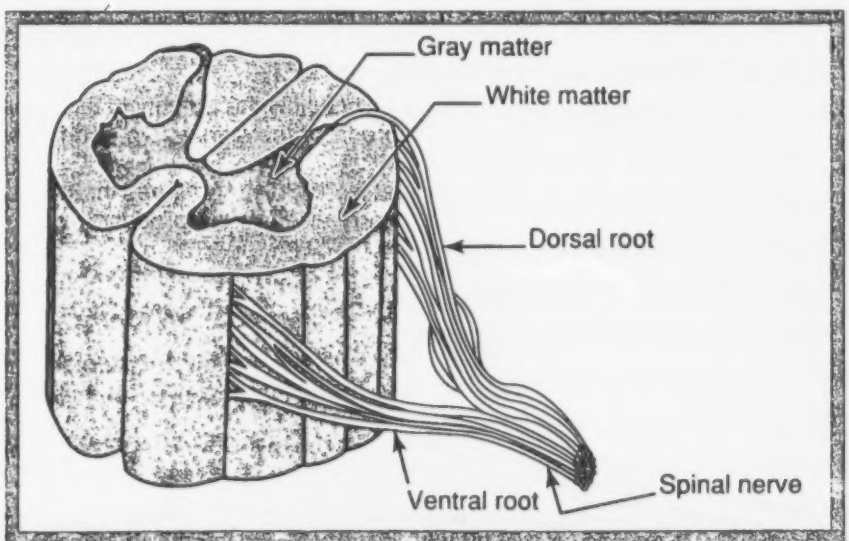


Figure 12.
Cross-section of the spinal cord.

OBJECTIVE 21 **State the function of cerebrospinal fluid.**

- Circulates around the brain and spinal cord to maintain an even pressure and act as a cushion or shock absorber

OBJECTIVE 22 **List the components of cerebrospinal fluid.**

1. **Water**
2. **Glucose**
3. **Sodium chloride**
4. **Protein**
5. **Some waste products, such as urea**

OBJECTIVE 23 **Define the major structures of the meninges.**

✔ **NOTE:** The spinal cord and the brain are covered by three layers called *meninges*. These three layers provide some protection for the brain and spinal cord. The layers have Latin names that describe their structure. The tough outer layer is called the *dura mater* (dur´-uh ma-tuhr), which means *hard mother* in Latin. The middle layer resembles a spider's web and is called the *arachnoid* (uh-rak´-noid), which means *spider-like* in Latin. The third, soft, inner layer contains nourishing blood vessels and is called the *pia mater*, which means *tender mother* in Latin.

1. **Dura mater**—The hard, outermost protective layer of the meninges that is composed of connective tissue
2. **Subdural space**—The cavity beneath the dura mater that is filled with serous fluid
3. **Arachnoid**—The middle layer of the meninges that resembles a spider's web
4. **Subarachnoid space**—The cavity below the arachnoid that is filled with cerebrospinal fluid and acts as a shock absorber for the spinal cord and the brain
5. **Pia mater**—The soft, innermost layer of the meninges that contains blood vessels that nourish the tissue layers and carry away waste products

OBJECTIVE 24 **Define the primary divisions of the brain** (see Figure 13 on the next page).

1. **Forebrain**—The prosencephalon (praws-en-se´-fuh-lawn); the anterior division of the brain
2. **Midbrain**—The mesencephalon (me-zen-se´-fuh-lawn); the middle division of the brain
3. **Hindbrain**—The rhombencephalon (rawm-ben-se´-fuh-lawn); the posterior division of the brain

OBJECTIVE 25

Label the primary divisions of the brain (see Figure 13).

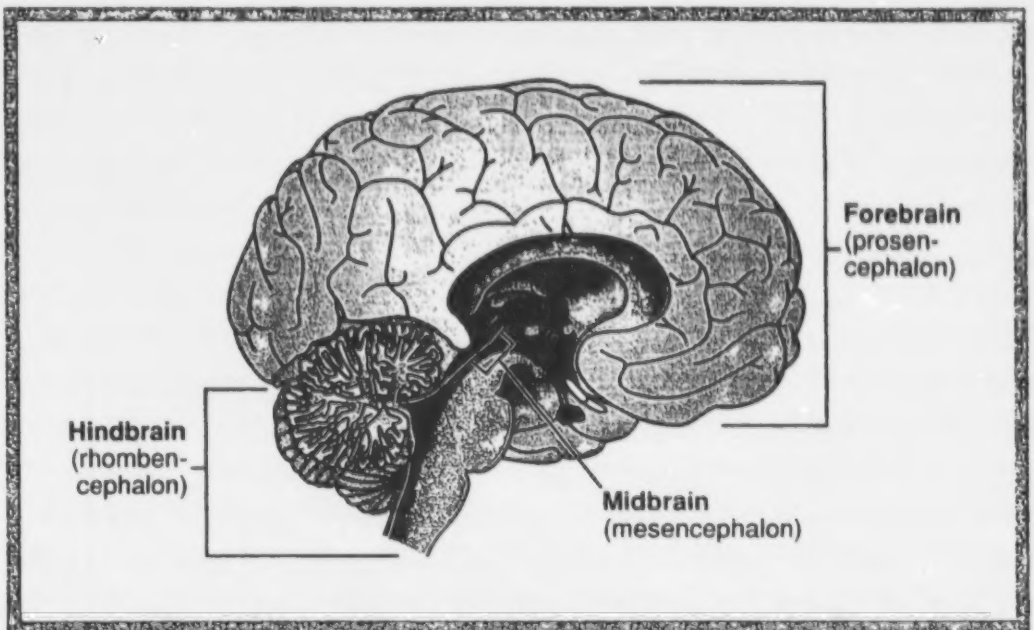


Figure 13
Primary divisions of the brain

OBJECTIVE 26

Define the major structures of the forebrain (prosencephalon) and the hindbrain (rhombencephalon) (see Figure 14 on the next page).

1. **The major structures of the forebrain (prosencephalon)**

   - Cerebrum (suh-re´-bruhm)—The telencephalon (te-len-se´-fuh-lawn); the anterior portion of the brain that is considered to be the seat of conscious mental processes

   - Diencephalon (di-uhn-se´-fuh-lawn)—The posterior subdivision of the forebrain that includes the thalamus (tha´-luh-muhs), which serves as a relay center and functions in the integration of sensory information, and the hypothalamus (hi-po-tha´-luh-mus), which controls body temperature, water balance, sleep, appetite, some emotions, and both divisions of the autonomic nervous system

2. **The major structures of the hindbrain (rhombencephalon)**

   - Cerebellum (ser-uh-be´-luhm)—The posterior portion of the hindbrain that serves to maintain body balance, equilibrium, coordination, and muscle tone

   - Medulla oblongata (muh-duh´-luh aw-blon-ga´-tuh)—The portion of the hindbrain that is continuous posteriorly with the spinal cord and serves to control vital functions such as breathing, heart rate, blood pressure, swallowing, and coughing

- Pons (pawnz´)—The portion of the hindbrain that is at the anterior end of the medulla oblongata and serves to relay impulses between the cerebrum and the cerebellum and the cerebrum and the medulla oblongata

OBJECTIVE 27

Label the major structures of the forebrain (prosencephalon) and the hindbrain (rhombencephalon) (see Figure 14).

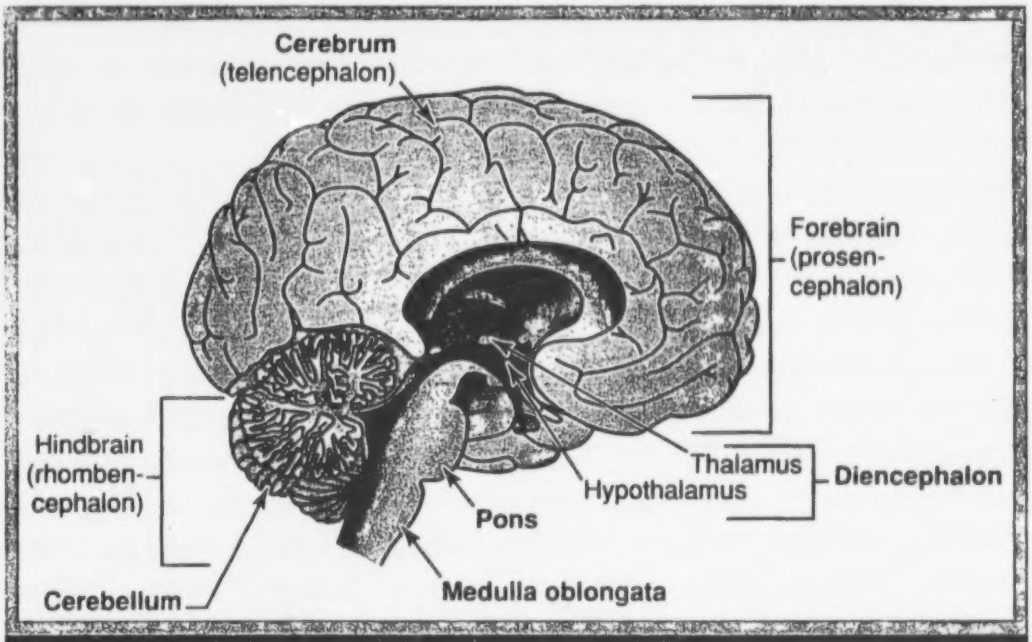


Figure 14
Major structures of the forebrain and hindbrain

OBJECTIVE 28

Define the terms *hemisphere, sulcus, fissure, lobe,* and *ventricle*.

1. **Hemisphere** (he´-muh-sfir)—One half of a sphere; the lateral half of the cerebrum or cerebellum
2. **Sulcus** (sul´-kuhs)—A shallow groove, a depression, or a furrow on the surface of an organ
3. **Fissure** (fish´-uhr)—A cleft or a groove on the surface of an organ, marking division of the organ into parts

   ✔ **NOTE:** A sulcus is usually not as deep as a fissure, but the terms are often used interchangeably.
4. **Lobe** (lob´)—A portion of any organ that is demarcated by sulci, fissures, or connective tissue
5. **Ventricle** (ven´-tri-kuhl)—A small cavity, such as the cavities filled with cerebrospinal fluid in the brain

OBJECTIVE 29

Define the lobes of the cerebrum (see Figure 15-a on the next page).

✔ **NOTE:** The cerebrum consists of two hemispheres that are divided by a fissure. The hemispheres are each divided into five lobes—the frontal, parietal, occipital, temporal, and central. The frontal, parietal, occipital, and temporal lobes are named for the bones that are above them. The central lobe is hidden from view.

1. **Frontal lobe**—The anterior division of each cerebral hemisphere that controls voluntary muscles and judgment
2. **Parietal lobe**—The middle division of each cerebral hemisphere that controls sensory functions such as pain, touch, and temperature interpretation
3. **Occipital lobe**—The posterior lobe of each cerebral hemisphere that controls vision
4. **Temporal lobe**—A large lobe of each cerebral hemisphere that is situated in front of the occipital lobe and controls hearing, smell, and taste

KEY TERMS

Parietal (puh-ri´-uh-tuhl)—Of, relating to, or forming the upper posterior wall of the head

Occipital (awk-si´-puh-tuhl)—Of, relating to, or located within or near the occiput or the occipital bone

Temporal (tem´-puh-ruhl)—Of or relating to the temples or the sides of the skull behind the orbits

5. **Central lobe**—One of the lobes constituting each of the cerebral hemispheres and lying hidden in the depths of the lateral sulcus

OBJECTIVE 30

Define the fissures of the cerebrum (see Figure 15-b on the next page).

1. **Longitudinal fissure**—The fissure that divides the cerebrum into two hemispheres
2. **Central fissure**—The fissure that divides the frontal lobe laterally from the parietal lobe
3. **Lateral fissure**—The fissure that separates the temporal lobe from the parietal lobe

OBJECTIVE 31 | **Label the visible lobes and fissures of the cerebrum** (see Figure 15).

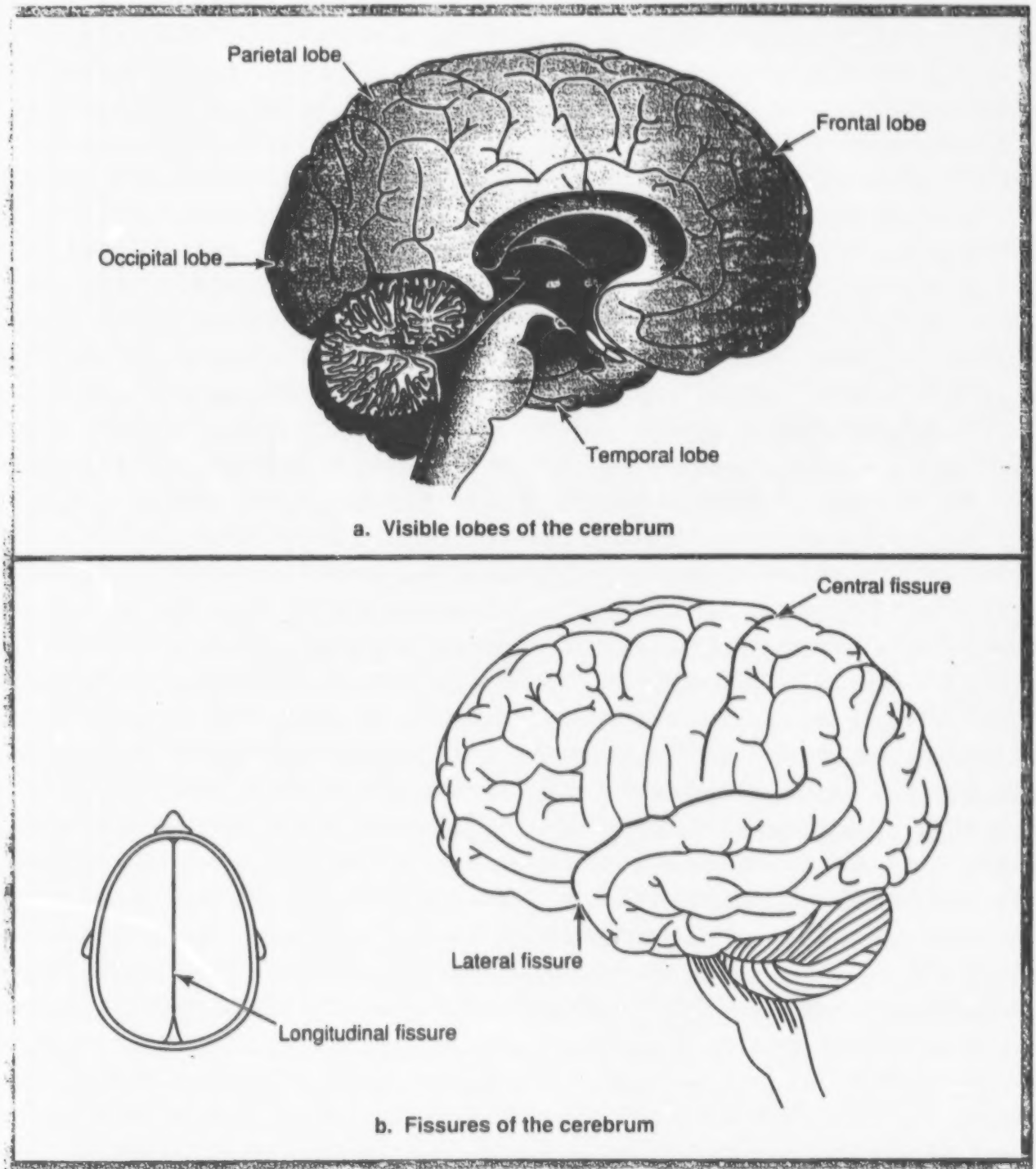


Figure 15
Visible lobes and fissures of the cerebrum

OBJECTIVE 32

Label the functional areas of the brain (see Figure 16).

✔ **NOTE:** The various regions within a lobe have specific control functions that they perform. The drawing below gives a general idea of the location of these functions within the brain.

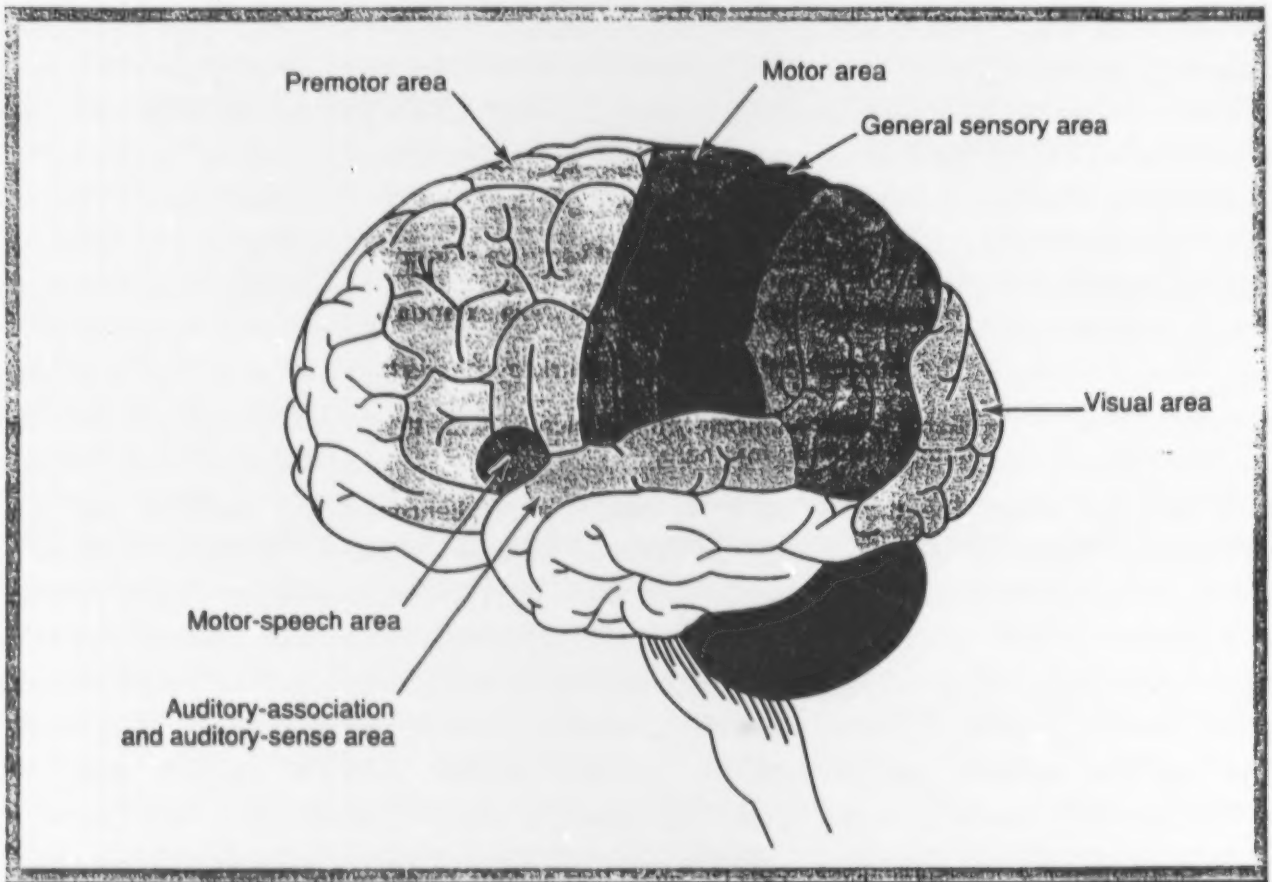


Figure 16
Functional areas of the brain

OBJECTIVE 33

Complete statements that describe the structure and functioning of the ventricles of the brain.

1. **There are four ventricles in the brain: two lateral ventricles and the third and fourth ventricles** (see Figure 17-a on the next page).
2. **The ventricles are filled with cerebrospinal fluid.**
3. **The ventricles are continuous with the central canal of the spinal cord.**
4. **The lateral ventricles are located inside the cerebral hemispheres.**
5. **Each lateral ventricle possesses a posterior, anterior, and inferior horn** (see Figure 17-b on the next page).
6. **The posterior horn of a lateral ventricle extends into the occipital lobe.**
7. **The anterior horn of a lateral ventricle extends into the frontal lobe.**
8. **The inferior horn of a lateral ventricle extends into the temporal lobe.**
9. **Each lateral ventricle communicates with the third ventricle by way of the interventricular foramen.**
10. **The third ventricle is located in the diencephalon with the thalamus and hypothalamus.**
11. **The cerebral aqueduct (aqueduct of Sylvius) connects the third ventricle with the fourth ventricle.**
12. **The fourth ventricle lies between the cerebellum and the pons and the medulla.**
13. **The fourth ventricle communicates with the subarachnoid space of the spinal canal through one medial foramen** (foramen of Magendie) **and two lateral foramina** (foramina of Luschka).
14. **Inside each ventricle are tiny masses of specialized capillaries called *choroid plexuses*** (kor´-oid plek´-suhs) **that secrete cerebrospinal fluid.**

KEY TERMS

Foramen (fuh-ra´-muhn)—An opening in a membranous structure

Aqueduct (a´-kwuh-duhkt)—A canal or passage in a part or organ

1136

OBJECTIVE 34

Label the ventricles of the brain and the horns of the lateral ventricles (see Figure 17).

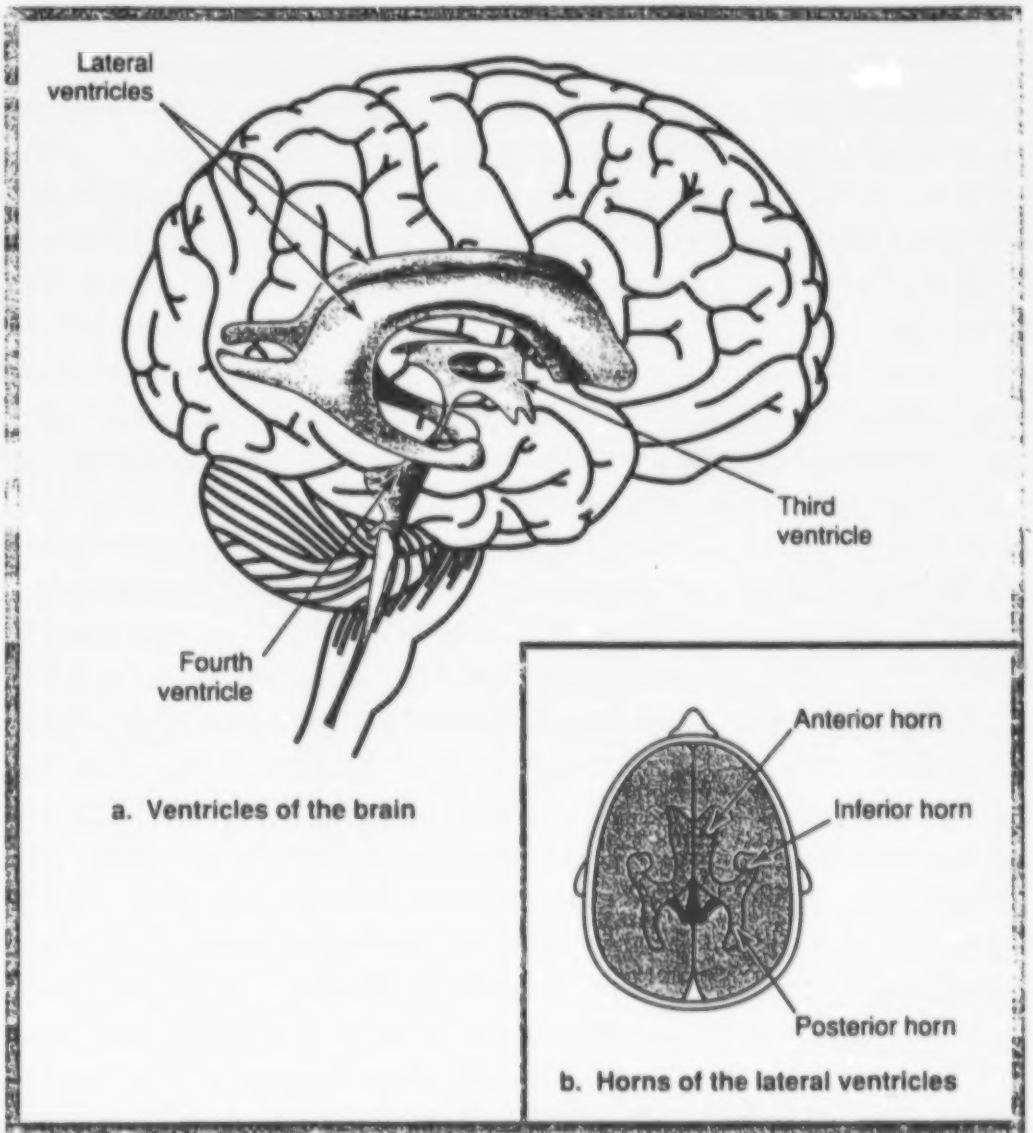


Figure 17
Ventricles of the brain and the horns of the lateral ventricles

OBJECTIVE 35

State the number and functions of the cranial nerves of the peripheral nervous system (see Figure 18 on the next page).

✔ **NOTE:** The peripheral nervous system includes 12 pairs of cranial nerves, which emerge from the cranial cavity through various openings in the base of the skull, and 31 pairs of spinal nerves, which emerge from the spinal cord. You will study the cranial nerves in this objective and the spinal nerves in the next.

Cranial nerves are designated by Roman numerals, with I being the most anterior. Certain cranial nerves, particularly V, VII, and VIII, contain two or more independent functional components that are considered as independent nerves by some authorities who classify 15 pairs of nerves in all.

1. **Olfactory** (awl-fak´-tre)—Nerve pair I; support the sense of smell
2. **Optic** (awp´-tik)—Nerve pair II; support the sense of sight
3. **Oculomotor** (aw-kyuh-luh-mo´-tuhr)—Nerve pair III; control four muscles of the eye
4. **Trochlear** (traw´-kle-uhr)—Nerve pair IV; control some of the eye muscles
5. **Trigeminal** (tri-je´-muh-nuhl)—Nerve pair V; control the muscles of the **cornea** and **conjunctiva**, the upper portion of the face, the ear, the lower lip, the teeth, the gums, and the muscles for chewing
6. **Abducens** (ab-du´-senz)—Nerve pair VI; control lateral eye movement
7. **Facial** (fa´-shuhl)—Nerve pair VII; supply the face muscles, the middle ear, and the taste sensors
8. **Auditory** (o´-duh-tor-e)—Nerve pair VIII; support the sense of hearing and balance
9. **Glossopharyngeal**—Nerve pair IX; support the sense of taste and control swallowing
10. **Vagus** (va´-guhs)—Nerve pair X; control swallowing, hunger, speech, breathing, heart rate, **peristalsis**, and glands in the stomach and **pancreas**
11. **Spinal accessory**—Nerve pair XI; control the muscles of the neck and upper back
12. **Hypoglossal** (hi-puh-glaw´-suhl)—Nerve pair XII; control the tongue muscles

KEY TERMS

Cornea (kor´-ne-uh)—The transparent part of the coat of the eyeball that covers the iris and pupil and admits light to the interior

Conjunctiva (kawn-juhnk-ti´-vuh)—The mucous membrane that lines the inner surface of the eyelids and continues over the forepart of the eyeball

Peristalsis (per-uh-stal´-suhs)—Successive waves of involuntary contractions that pass along the walls of a hollow muscular structure, such as the esophagus or the intestine, and force the contents onward

Pancreas (pan´-kre-uhs)—A large gland that secretes digestive enzymes and the hormones insulin and glucagon

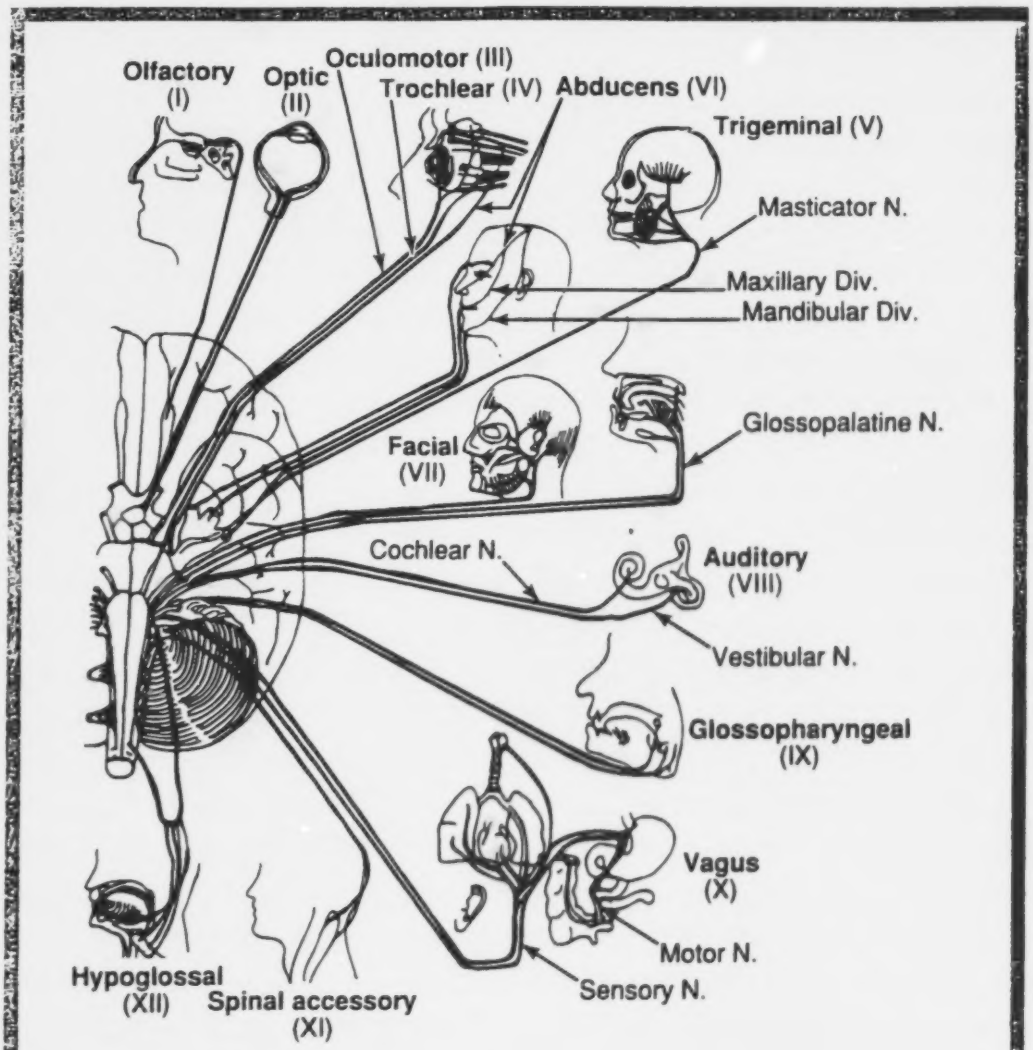


Figure 18
Cranial nerves of the peripheral nervous system

OBJECTIVE 36

Define the term *plexus*.

- **Plexus** (plek´-suhs)—A network of nerves from several segments of the spinal cord that combine to form nerves to specific parts of the body

✔ **NOTE:** There are five plexuses of the spinal cord: (1) the cervical plexus, (2) the brachial plexus, (3) the lumbar plexus, (4) the sacral plexus, and (5) the coccygeal plexus. Roughly speaking, the plexuses are named according to the segment of the spinal cord to which they are attached (see Figure 19 on the next page). For example, the cervical plexus is located near the cervical region of the spinal cord.

OBJECTIVE 37

Label the plexuses of the spinal cord (see Figure 19).

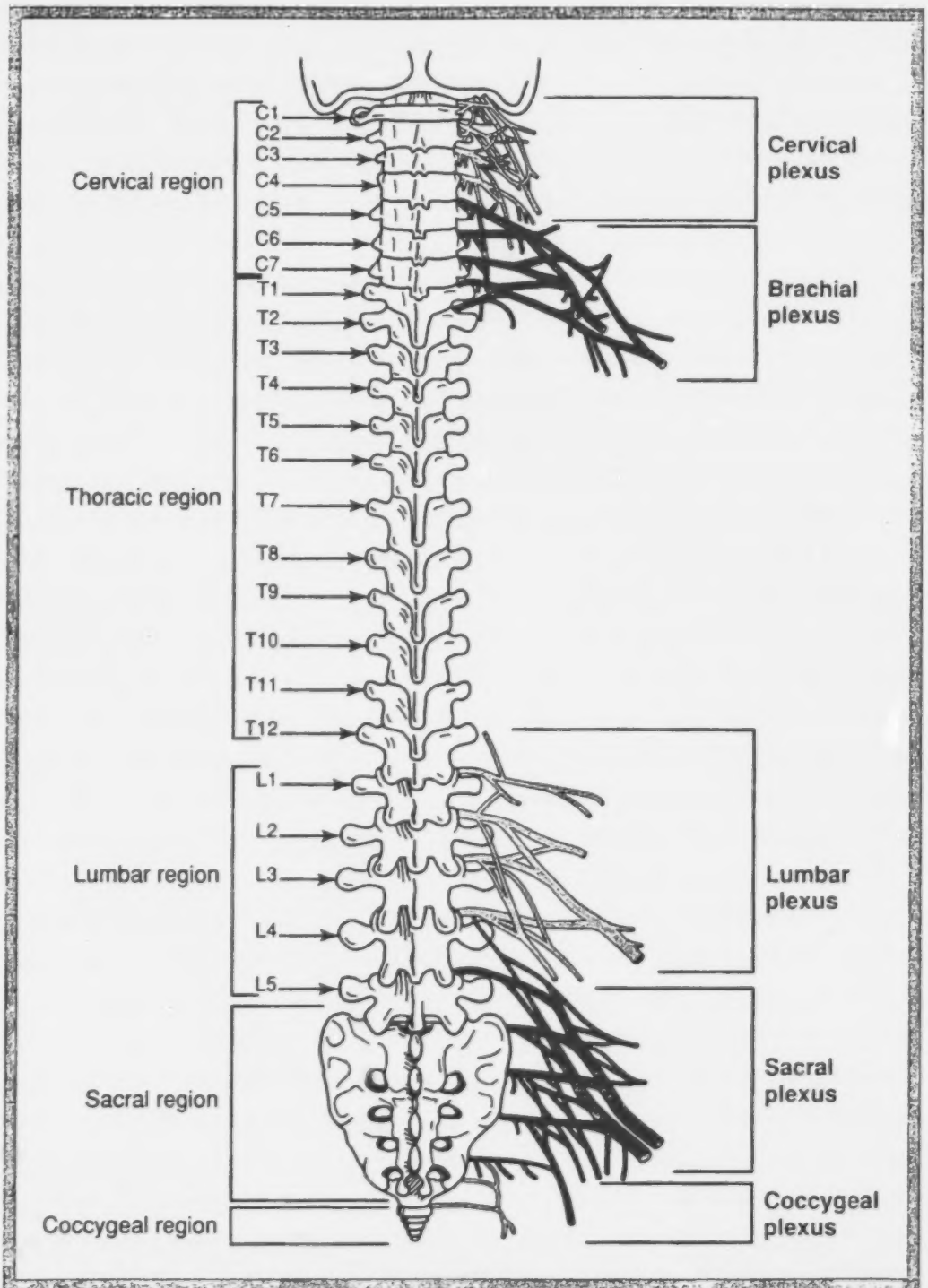


Figure 19
Plexuses of the spinal cord

OBJECTIVE 38

Describe the number and origin of the spinal nerves.

✔ **NOTE:** There are 31 pairs of spinal nerves.

1. **Cervical nerves**—The eight pairs of spinal nerves that arise from the neck area of the spinal cord
2. **Thoracic nerves**—The 12 pairs of spinal nerves on each side of the thorax, including 11 **intercostal** nerves and one subcostal nerve

   ✔ **NOTE:** The thoracic nerves do not enter a plexus but follow independent courses, making them different from other spinal nerves.

KEY TERM

Intercostal—Of or pertaining to the space between two ribs

3. **Lumbar nerves**—The five pairs of spinal nerves that arise in the lumbar region of the spinal cord
4. **Sacral nerves**—The five pairs of spinal nerves that arise from the sacral region of the spinal cord
5. **Coccygeal nerves**—The single pair of spinal nerves that arises near the coccygeal region of the spinal cord

OBJECTIVE 39

List the major nerves that arise from each plexus.

1. **Major nerves that arise from the cervical plexus**
   - C-1 through C-4
   - **Phrenic**

KEY TERM

Phrenic (fre´-nik)—Of or relating to the diaphragm

✔ **NOTE:** The phrenic nerve is generally known as the *motor nerve to the diaphragm.*

2. **Major nerves that arise from the brachial plexus**
   - C-5 through C-8
   - T-1
   - **Axillary** nerve

- **Radial** nerve
- **Median** nerve
- **Ulnar** nerve

KEY TERMS

Axillary (ak´-suh-ler-e)—Of or pertaining to the axilla, the cavity beneath the junction of the forelimb and the body

✔ **NOTE:** The axillary nerve is located in the area of the axilla.

Radial (ra´-de-uhl)—Pertaining to the radius, one of the bones of the forearm, lying parallel to the ulna

✔ **NOTE:** The radial nerve serves the area of the radius.

Median nerve—The nerve that extends along the radial portions of the forearm and the hand and supplies various muscles and the skin of these parts

Ulnar (uhl´-nuhr) **nerve**—The nerve that supplies the muscles on the ulnar side of the forearm and hand

3. **Major nerves that arise from the lumbar plexus**
   - L-1 through L-4
   - **Femoral** nerve

KEY TERM

Femoral (fe´-muh-ruhl)—Of or pertaining to the femur or thigh

✔ **NOTE:** The femoral nerve is primarily located in the region of the thighbone.

4. **Major nerves that arise from the sacral plexus**
   - L-4 and L-5
   - S-1 through S-4
   - **Sciatic** nerve

KEY TERM

Sciatic (si-at´-ik)—Near the ischium, the hipbone

✔ **NOTE:** The sciatic nerve is a long nerve that extends through the muscles of the thigh, leg, and foot.

5. **Major nerves that arise from the coccygeal plexus**
   - S-4 and S-5
   - Coccygeal nerve

OBJECTIVE 40

Match common disorders and abnormalities of the nervous system to their correct definitions.

1. **Multiple sclerosis** (muhl-tuh-puhl skluh-ro´-suhs)—A **progressive** nerve disorder that leads to **degeneration** of the myelin sheaths of CNS nerve cells, is marked by patches of hardened tissue in the brain or the spinal cord, and is associated with partial or complete paralysis and jerking muscle tremor

KEY TERMS

Sclerosis –Any pathological hardening of tissue

Progressive (pruh-gres´-iv)—Becoming more involved

✔ **NOTE:** The terms *progressive* and ***degenerative*** have somewhat similar meanings. Both refer to conditions in which the patient's condition worsens. However, progressive can indicate that additional symptoms may appear over time or that additional systems may become involved. For example, after a CVA (see item 10 in this objective) a person's speech may be impaired. If the speech region of the brain degenerates, the patient's ability to speak will worsen and may eventually be lost all together. An infection of the meninges may be progressive in that it may spread from the spinal cord to the brain. Undoubtedly the patient's health will degenerate, but the disease is also progressive in that its effects spread and reach more parts of the body.

Degenerative (di-jen´-uh-rat-iv)—Worsening

✔ **NOTE:** A medical condition is degenerative when its effects on the body and normal functioning continue to get worse. Often, the term carries a sense that a condition will never improve.

2. **Neuroma** (nu-ro´-muh)—The general term for any tumor arising from a nerve and usually consisting of nerve fiber
3. **Glioma** (gle-o´-muh)—A generally benign tumor arising from neuroglia
4. **Astrocytoma** (as-truh-si-to´-muh)—A tumor that occurs in astrocytes
5. **Ependymoma** (e-pen´-di-mo-muh)—A tumor that arises in the lining of a ventricle and may extend to the spinal cord

   ✔ **NOTE:** An ependymoma may also be called an *ependymocytoma.*
6. **Acoustic neuroma**—A tumor that develops from the eighth cranial (auditory) nerve and grows within the auditory canal
7. **Multiple neurofibromatosis** (nur-o-fi-bro-muh-to´-suhs)—An inherited disease that produces numerous benign tumors in the Schwann cells of the nerve cells of the skin
8. **Meningitis** (me-nuhn-ji´-tuhs)—An inflammation of the meninges usually caused by a bacterial infection

9. **Hydrocephalus** (hi-dro-suh´-fuh-luhs)—An increase in the amount of cerebrospinal fluid in the cranial cavity, resulting in an enlargement of the skull and especially the forehead and atrophy of the brain

10. **Cerebrovascular** (suh-re-bro-vas´-kyuh-luhr) **accident** (CVA)—A lesion in the brain; a stroke

    ✔ **NOTE:** A cerebrovascular accident, or CVA, results from a lack of oxygen to the brain due to damage to a blood vessel. Common types of damage include **thrombus** and **aneurysm**. Strokes often lead to partial paralysis that may be exhibited as hemiplegia, paraplegia, triplegia, or quadriplegia.

KEY TERMS

Thrombus (thrawm´-buhs)—A blood clot that obstructs a blood vessel and can thereby prevent the flow of blood to a region of the body

✔ **NOTE:** A thrombus will often form in one part of the body and break loose only to become lodged in a smaller vessel.

Aneurysm (an´-yuh-ri-zuhm)—A weak spot in a blood vessel—generally an artery—that allows a bubble or sac to form in the wall of the vessel

✔ **NOTE:** An aneurysm may rupture, creating a hemorrhage. If this condition occurs in the brain, the loss of blood deprives the brain of oxygen and the blood destroys neurons.

11. **Cerebral palsy** (suh-re´-bruhl pol´-ze)—A disability that results from injury before or during birth that leads to poor muscle coordination and speech distrubances

12. **Alzheimer's** (awlts´-hi-muhrz) **disease**—A progressive disease of the central nervous system that results in loss of memory and reduced intellectual ability and speech and motor control

13. **Huntington's** (huhn´-tin-tuhnz) **disease**—An inherited disease that leads to involuntary, purposeless movements

14. **Parkinson's** (par´-kuhn-suhnz) **disease**—A degenerative condition in neurons that leads to overstimulation of skeletal muscles, marked by tremor and weakness of resting muscles and by a shuffling gait

15. **Epilepsy** (e´-puh-lep-se)—A condition of recurring or chronic seizures

16. **Herpes zoster** (huhr´-pez zaws-tuhr)—A viral infection of the sensory fibers in the skin, causing a painful eruption of red patches

    ✔ **NOTE:** Herpes zoster is commonly referred to as *shingles.*

17. **Trigeminal** (tri-je´-muh-nuhl) **neuralgia**—A condition of recurring pain as a result of disease or injury in the trigeminal (C5) nerve

    ✔ **NOTE:** This condition is referred to as *tic douloureux* (tik´ du-luh-ru´), which is French for "painful twitch."

OBJECTIVE 41

Assignment Sheet 1—Practice Critical Thinking: Investigate Nerve-Block Anesthetics

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

The term *nerve block* refers to various techniques in which a local anesthetic is injected around a nerve to temporarily numb the area served by that nerve. In effect, the anesthetic "blocks" signals from the nerves from being transmitted to the brain, thus preventing the sensation of pain or motor responses during surgical procedures. Nearly fifty different blocks have been developed, but fewer than a dozen are in common use. Some blocks, such as spinal and epidural blocks, numb several nerves at one time, while other nerve blocks are specific to a single nerve. Nerve blocks are used for a number of medical interventions, including as a surgical anesthetic in which it is desirable to have the patient conscious. Blocks are also used for pain management and even for treatment of some conditions.

Many factors go into making the decision of whether or not to use a nerve block. In some cases, the basis of the decision may be the patient's preference or the surgeon's preference. However, some procedures, such as brain surgery, cannot be done with a nerve block.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Study the report form provided on page 39.

_____ 3. Check with your instructor to determine which one or more types of nerve-block procedures and anesthetic you will investigate. Indicate the topic or topics of your report on the blank lines below.

_____ 4. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in presenting your report. Describe that format on the blank lines provided below.

_____ 5. Check with your instructor to agree upon the criteria he or she will use to evaluate your presentation. Describe those criteria on the blank lines provided below.

_____ 6. Make additional copies of the report form on page 39.

_____ 7. Complete a report form for each nerve-block procedure and anesthetic you have been assigned.

_____ 8. Review your forms, complete your report presentation, and return your forms and your report presentation to your instructor for evaluation.

Nerve-block procedure(s) and anesthetic assigned _____

_____

_____

_____

_____

_____

Format of report _____

_____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

_____

Report Form

1. What type of nerve block are you investigating? _____

2. What nerve or nerves are blocked with this procedure? _____

3. When is this procedure used and for what purpose? _____

4. What type(s) of anesthetic is commonly used in this block technique? _____

5. Where and how is the anesthetic administered? _____

6. What are possible side-effects and contraindications for this procedure? _____

MODULE SET II:
Major Body Systems

Module 5: Endocrine System

Module Contents

		Page
COMPONENTS	Learning Activities Sheet	3
	Module Objective Sheet	5
	Information Sheet	7
	Assignment Sheet	
	1—Practice Critical Thinking: Complete Case Studies that Determine Medical Interventions for Endocrine Disorders	21

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

❑	1.	Take	Pretest provided by your instructor.
❑	2.	Stop	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
❑	3.	Read	Module Objective Sheet.
❑	4.	Study	Information Sheet, Objective 1 through Objective 21.
❑	5.	Research	Online resources to learn more about the endocrine system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

❑	6.	Take	Written Test provided by your instructor.
❑	7.	Stop	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
❑	8.	Do	Assignment Sheet 1, "Practice Critical Thinking: Complete Case Studies that Determine Medical Interventions for Endocrine Disorders."
❑	9.	Stop	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
❑	10.	Check	With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the endocrine system, state the functions of the major organs of the endocrine system, and define common disorders and abnormalities associated with the hormones of the endocrine system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *endocrine system*.
2. List the primary physiological characteristics of the body that are affected by the hormones of the endocrine system.
3. Match the major glands of the endocrine system to their correct definitions.
4. Label the major glands of the endocrine system.
5. Complete statements that describe the structure and function of the pituitary gland.
6. Match the primary hormones of the pituitary gland to their correct functions.
7. Define common disorders and abnormalities associated with the hormones of the pituitary gland.
8. Complete statements that describe the function of the thyroid gland.
9. Define common disorders and abnormalities associated with the hormones of the thyroid gland.
10. Complete statements that describe the function of the parathyroid glands.
11. Define common disorders and abnormalities associated with the hormones of the parathyroid glands.
12. Complete statements that describe the structure and function of the adrenal glands.
13. Match the primary hormones of the adrenal glands to their correct functions.
14. Define common disorders and abnormalities associated with the hormones of the adrenal glands.
15. Complete statements that describe the function of the gonads.
16. Describe the common disorders and abnormalities associated with the hormones of the gonads.
17. Complete statements that describe the function of the pancreas (islets of Langerhans).

18. Define common disorders and abnormalities associated with the hormones of the pancreas (islets of Langerhans).

19. Complete statements that describe the function of the pineal body.

20. Complete statements that describe the function of the thymus gland.

21. Complete statements that describe the endocrine functions of organs in the body that are not classified as endocrine glands.

22. Practice critical thinking: complete case studies that determine medical interventions for endocrine disorders. (Assignment Sheet1)

Information Sheet

OBJECTIVE 1

Define the term *endocrine system*.

- **Endocrine** (en´-duh-kruhn) **system**—The network of ductless glands and other structures that **elaborate** and secrete **hormones** directly into the bloodstream, affecting the function of specific target organs (see Figure 1).

  ✔ **NOTE:** Secretions from the endocrine glands affect various processes throughout the body, such as metabolism, growth, and secretions from other organs.

KEY TERMS

Elaborate (i-la´-buh-rat)—To build up in a process by which a gland synthesizes a complex substance from simpler substances and secretes it

Hormone (hor´-mon)—A substance containing amino acid that originates in an organ or gland, moves through the blood to another part of the body, and stimulates activity in that region by chemical reaction

✔ **NOTE:** Numerous types of hormones are secreted by various glands, and each hormone produces different **physiological** effects. You will study these glands and hormones and their physiological effects in the objectives that follow.

Physiological (fi-ze-uh-law´-ji-kuhl)—Characteristic of or appropriate to an organism's health or normal functioning

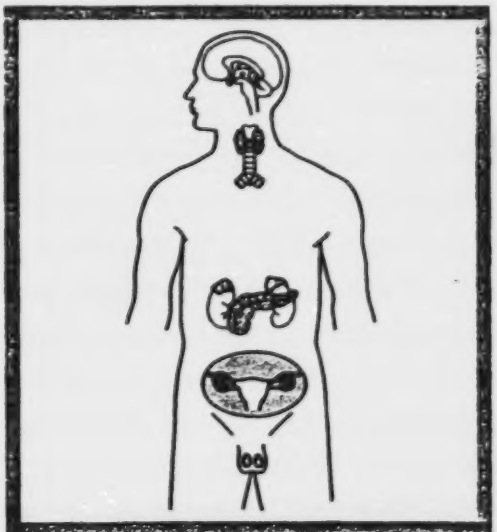


Figure 1
Endocrine system

OBJECTIVE 2

List the primary physiological characteristics of the body that are affected by the hormones of the endocrine system.

✔ **NOTE:** In essence, hormones affect the functioning of the body by adjusting chemical reactions in the body. These effects may be to speed up or slow down a chemical reaction, to produce other chemicals that can be used by the body, to start or stop a reaction, or to cause special effects that are not part of the normal functioning of the body, such as delivery of a child.

1. **Rate of metabolism**
2. **Metabolism of specific substances such as carbohydrates and calcium**
3. **Growth and development processes**
4. **Secretion of other hormones**
5. **Development and functioning of the reproductive organs**
6. **Sexual characteristics and libido**

KEY TERM

Libido (luh-be´-do)—Sexual drive and energy

7. **Development of higher mental functions**
8. **Ability of the body to meet conditions of stress**
9. **Resistance to disease**

OBJECTIVE 3

Match the major glands of the endocrine system to their correct definitions (see Figure 2 on page 10).

1. **Pituitary** (puh-tu´-uh-ter-e) **gland**—The endocrine gland that is located at the base of the brain in a small depression of the sphenoid (sfe´-noid) bone of the cerebrum, known as the *sella turcica* (sel´-uh turs´-i-kuh); the gland that is sometimes referred to as the *master gland* or *moderator gland* because it affects other glands in the endocrine system

   ✔ **NOTE:** The pituitary gland may also be referred to as the *hypophysis cerebri* (hi-paw´-fuh-suhs suh-re´-bre).

2. **Thyroid** (thi´-roid) **gland**—A glandular structure consisting of one lobe on either side of the trachea and connected in the midline by the **isthmus**; the largest of all the endocrine glands

KEY TERM

Isthmus (is´-muhs)—A narrow structure that joins two other structures

3. **Parathyroid glands**—The four, small, bean-shaped bodies that lie on the posterior surface of the lobes of the thyroid gland

4. **Adrenal** (uh-dre´-nuhl) **glands**—The endocrine glands that are located superior to the kidneys, each fitting like a cap on the top of each kidney

5. **Gonads** (go´-nadz)—The generic term for the sex glands of both sexes that produce the cells of reproduction; the **ovaries** in the female and the **testes** in the male

KEY TERMS

Ovary (o´-vuh-re)—One of the paired essential female reproductive organs that produces eggs

Testis (tes´-tuhs)—One of the paired male reproductive glands that produces sperm and that in most mammals is contained within the scrotum at sexual maturity

6. **Pancreas** (pan´-kre-uhs)—The fish-shaped, grayish-pink nodular gland that lies inferior to the stomach, functions both as an **exocrine** and endocrine gland, and contains special cells called the *islets of Langerhans* (i´-luhts of lan´-uhr-hawnz), which are scattered throughout the gland and produce endocrine secretions

KEY TERM

Exocrine (ek´-suh-kruhn) **gland** –A gland that releases a secretion external to or at the surface of an organ by means of a canal or duct

Examples: Salivary gland, part of the pancreas

7. **Pineal body**—The small, conical endocrine gland that lies near the middle of the brain

8. **Thymus** (thi´-muhs) **gland**—A glandular structure of largely **lymphoid** tissue typically located in the upper anterior chest or at the base of the neck

✔ **NOTE:** The thymus gland tends to atrophy in the adult.

KEY TERM

Lymphoid (lim´-foid)—Of, relating to, or being tissue (as of the lymph nodes or thymus) containing lymphocytes

OBJECTIVE 4 **Label the major glands of the endocrine system** (see Figure 2).

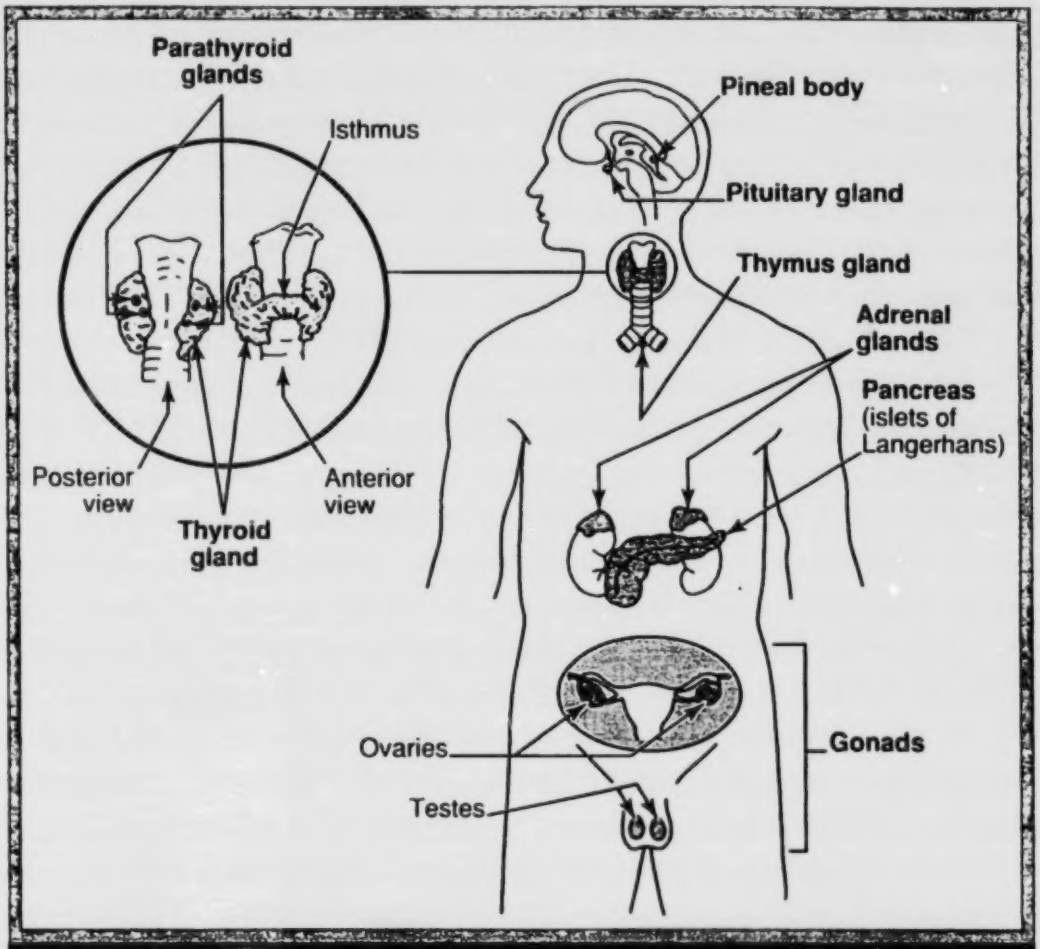


Figure 2
Major endocrine glands

OBJECTIVE 5 **Complete statements that describe the structure and function of the pituitary gland.**

1. **The pituitary gland is divided into two lobes—the posterior lobe and the anterior lobe.**
2. **The posterior lobe of the pituitary gland is connected to the hypothalamus** (hi-po-tha´-luh-muhs).
3. **Two hormones are produced by the hypothalamus and then are secreted by the posterior lobe of the pituitary gland** (see Objective 6).
4. **Six hormones are secreted from the anterior lobe of the pituitary gland** (see Objective 6).

5. **One hormone is secreted in the portion of the pituitary gland between the anterior and posterior lobes** (see Objective 6).

OBJECTIVE 6

Match the primary hormones of the pituitary gland to their correct functions.

1. **Hormones of the posterior lobe of the pituitary gland**

   - **Vasopressin** (va-zo-pre´-suhn)—Induces the contraction of the smooth muscles of the blood vessels to regulate blood pressure; is associated with an **antidiuretic** principle that prevents excessive loss of water through the kidneys; causes reabsorption of water in the **nephron tubes**

KEY TERMS

Antidiuretic (an-ti-di-yu-re´-tik)—A substance that increases reabsorption of water by the nephron tubes and, thus, reduces the amount of urine produced

Nephron tube (ne´-frawn tyub´)—The portion of the kidney that transports the urine produced to the urinary tract

   - **Oxytocin** (awk-si-to´-suhn)—Stimulates the **uterus** to contract and acts on the **mammary glands** to stimulate the release of milk

KEY TERMS

Uterus (yu´-tuh-ruhs)—The womb; the organ of the female for containing and nourishing the young during development previous to birth

Mammary (ma´-muh-re) **gland**—Any of the large compound glands that in female mammals are modified to secrete milk

2. **Hormones of the anterior lobe of the pituitary gland**

   - **Somatotropic** (so-ma-tuh-tro´-pik) **hormone**—Regulates growth

     ✔ **NOTE:** Somatotropic hormone is also called *somatotropin* (so-ma-tuh-tro´-puhn).

   - **Adrenocorticotropic** (uh-dre´-no-kor-ti-ko-tro-pik) **hormone**—Regulates the functional activity of the adrenal cortex

     ✔ **NOTE:** Adrenocorticotropic hormone is commonly referred to as *ACTH.*

   - **Thyrotropic** (thi-ruh-tro´-pik) **hormone**—Regulates the functional activity of the thyroid gland (see Objective 8)

- **Follicle-stimulating hormone**—Stimulates the development of the ovarian follicles and **spermatogenesis** in the testes

KEY TERM

Spermatogenesis (spuhr-ma-tuh-je´-nuh-suhs)—The production of sperm cells by the testes

- **Luteinizing** (lu´-te-uh-miz-ing) **hormone**—Induces the secretion of **estrogens**, **ovulation**, and the development of the **corpus luteum**

KEY TERMS

Estrogen (es´-truh-juhn)—A hormone secreted by a developing ovarian follicle that contributes to the development of female sexual characteristics

Ovulation (awv-yuh-la´-shuhn)—The release of an ovum from an ovary

Corpus luteum (kor´-puhs lu´-te-uhm)—A temporary endocrine gland formed from an ovarian follicle once an ovum has been released

✔ **NOTE:** The plural form is *corpora lutea*.

- **Luteotropic** (lu-te-uh-tro´-pik) **hormone**—Maintains the mature corpora lutea, induces the secretion of **progesterone**, and induces the secretion of milk in a fully developed mammary gland

KEY TERM

Progesterone (pro-jes´-tuh-ron)—A hormone that contributes to the maintenance of pregnancy

3. **Hormone of the portion of the pituitary gland between the lobes**

- **Melanocyte-stimulating** (muh-la´-nuh-sit) **hormone**—Influences **melanin** formation

KEY TERM

Melanin (me´-luh-nuhn)—A protein that serves as a pigment to provide color to the skin, hair, and eyes

OBJECTIVE 7 **Define common disorders and abnormalities associated with the hormones of the pituitary gland.**

1. **Diabetes insipidus** (di-uh-be´-tez in-si´-puhd-uhs)—A disorder caused by the inadequate secretion of the hormone vasopressin and characterized by the body's production of excessive amounts of urine

2. **Dwarfism** (dwor´-fi-zuhm)—An abnormality caused by the inadequate secretion of somatotropic hormone and characterized by underdevelopment of the body (extreme shortness of stature)

   ✔ **NOTE:** *Dwarfism* is a general term for "abnormally small stature," for any of various reasons. Most forms of dwarfism are inherited conditions, as is the pituitary dwarfism specifically described here.

3. **Giantism** (ji´-uhnt-i-zuhm)—An abnormality caused by the excessive secretion of somatotropic hormone in childhood and characterized by excessive size and stature

4. **Acromegaly** (a-kro-me´-guh-le)—An abnormality caused by the excessive secretion of somatotropic hormone in adults and characterized by enlargement of the bones of the hands, feet, jaw, and cheeks

OBJECTIVE 8 **Complete statements that describe the function of the thyroid gland.**

1. **The thyroid gland secretes the hormone thyroxine.**

KEY TERM

Thyroxine (thi-rawk´-sen)—A hormone of the thyroid gland that influences metabolic rate

2. **The thyroid gland requires the intake of iodine in order to synthesize thyroxine.**

3. **Thyroxine is transported in the blood by binding itself to proteins.**

4. **Thyroid function can be indicated by the measurement of protein-bound iodine in the plasma.**

KEY TERM

Protein-bound iodine (PBI)—Iodine that is firmly bound to protein in serum and can be used to measure the concentration of circulating thyroxine; a PBI of less than normal indicates hypothyroidism and a PBI of more than normal indicates hyperthyroidism

✔ **NOTE:** The measurement of PBI is used less frequently because of the availability of more-sensitive measurements.

5. **Thyroid hormones aid in regulating metabolism, especially the metabolism of carbohydrates and fats.**

6. **Thyroid hormones affect the secretion and function of somatotropic hormone.**

7. **Thyroid hormones are required for normal development of the central nervous system.**

OBJECTIVE 9 **Define common disorders and abnormalities associated with the hormones of the thyroid gland.**

1. **Goiter** (goi´-tuhr)—Any enlargement of the thyroid whether caused by normal or abnormal secretions of thyroxine

2. **Grave's disease**—A disorder characterized by pronounced hyperthyroidism (excessive secretion of thyroxine) usually associated with an enlarged thyroid gland, an abnormal protrusion of the eyeballs, nervousness, a fine tremor of the hands, weight loss, fatigue, and increased heat intolerance

   ✔ **NOTE:** Grave's disease may also be called *exophthalmic* (ek-sawf-thal´-mik) *goiter, thyrotoxicosis,* or *toxic goiter.*

3. **Myxedema** (mik-suh-de´-muh)—A disorder characterized by hypothyroidism (inadequate secretion of thyroxine) in adults and associated with decreased metabolism, increased weight, hair loss, and thickening of the skin due to fluid accumulation

   ✔ **NOTE:** Myxedema is the most-severe form of hypothyroidism, and the disorder may lead to coma and death.

4. **Cretinism** (kre´-tuhn-iz-uhm)—A disorder characterized by hypothyroidism (inadequate secretion of thyroxine) in childhood and associated with stunted growth, mental deficiency, puffy facial features, a large tongue, and muscular incoordination

OBJECTIVE 10 **Complete statements that describe the function of the parathyroid glands.**

1. **The parathyroid glands secrete parathormone** (par-uh-thor´-mon).

2. **Parathormone acts to maintain a constant concentration of calcium in the extracellular fluid; the hormone regulates the absorption of calcium from the GI tract, mobilization of calcium from the bones, deposition of calcium in the bones, and excretion of calcium in the breast milk, feces, sweat, and urine.**

   ✔ **NOTE:** Parathormone may also be called *parathyroid hormone* or PH.

3. **Neuromuscular irritability is inversely related to blood-calcium concentration—neuromuscular irritability increases when the blood concentration of calcium decreases.**

OBJECTIVE 11 **Define common disorders and abnormalities associated with the hormones of the parathyroid glands.**

1. **Hypocalcemic tetany** (hi-po-kal-se´-mik te´-tuhn-e)—An abnormality in calcium metabolism characterized by inadequate secretion of parathormone and associated with cramps, convulsions, twitching of the muscles, and sharp flexion of the wrist and ankle joints

   ✔ **NOTE:** Tetany will result in death if calcium treatment is not given.

2. **Hypercalcemia** (hi-puhr-kal-se´-me-uh)—An abnormally high amount of calcium in the blood characterized by excessive secretion of parathormone and associated with confusion, anorexia, abdominal pain, muscle pain, and weakness

OBJECTIVE 12 **Complete statements that describe the structure and function of the adrenal glands.**

1. **Each of the two adrenal glands consists of a cortex and a medulla that function independently.**
2. **The adrenal cortex is essential to life because the hormones it secretes** (see Objective 13) **assist the body in adapting to the constant changes in the environment.**
3. **The adrenal medulla is not essential to life, but the hormones it secretes** (see Objective 13) **function in conjunction with the sympathetic nervous system to help individuals meet certain types of emergency situations.**
4. **Complete removal of both adrenal glands would result in death unless substitute hormones are administered to the individual.**

OBJECTIVE 13 **Match the primary hormones of the adrenal glands to their correct functions.**

✔ **NOTE:** Six hormones are produced in the adrenal cortex, and two are produced in the adrenal medulla of each adrenal gland.

1. **Hormones of the adrenal cortex**

   - **Aldosterone** (al-daws´-tuh-ron)—Regulates the metabolism of sodium, chloride, and potassium and, therefore, regulates the water and electrolyte balance of the body
   - **Cortisol** (kor´-tuh-sol)—Improves the body's efficiency in using nutrients
   - **Corticosterone** (kor-tuh-kaws´-tuh-ron)—Functions in conjunction with cortisol to regulate metabolism

     ✔ **NOTE:** Cortisol and corticosterone principally regulate carbohydrate metabolism but also regulate fat and protein metabolism. Therefore, they affect essentially every cell in the body.

- **Androgens**—Regulate the development and maintenance of male sexual characteristics

KEY TERM

Androgen (an-druh´-juhn)—The generic term for any hormone or other substance that supports male sexual development

- **Estrogens**—Regulate the development and maintenance of female sexual characteristics and the cyclic changes in the **vagina** and uterus

KEY TERMS

Estrogen (es´-truh-juhn)—The generic term for the hormone secreted by the ovaries and the adrenal cortices that promote female sexual characteristics

Vagina (vuh-ji´-nuh)—The canal in a female that leads from the uterus to the external orifice of the genital canal

- **Progesterone** (pro-jes´-tuh-ron)—Produces changes in the uterine lining in the second half of the **menstrual cycle**, promotes the maintenance of pregnancy, promotes the development of the maternal **placenta**, and promotes the development of mammary glands

KEY TERMS

Menstrual (men{t}´-stru-uhl) **cycle**—The cyclic changes that occur in the female reproductive system during child-bearing years

Placenta (pluh-sen´-tuh)—The membrane that forms during pregnancy to serve as an area for exchanging materials between the mother and the fetus

2. Hormones of the adrenal medulla

- **Epinephrine** (e-puh-ne´-fruhn)—Narrows blood vessels, increases heart activity, dilates **bronchi**, increases the level of glucose in the blood by stimulating the liver, increases the amount of fatty acid in the blood, and diminishes the activity of the gastrointestinal system

✔ **NOTE:** Epinephrine assists the body in responding to stressful situations.

KEY TERM

Bronchus (brawn´-kuhs)—Either of the two divisions of the trachea that lead into the right or left lung

- **Norepinephrine** (nor-e-puh-ne´-fruhn)—Constricts **arterioles** and **venules**, which results in increased resistance to blood flow, elevated blood pressure, and slowing of the heart

  ✔ **NOTE:** Norepinephrine is a precursor of epinephrine and raises blood pressure in stressful situations.

KEY TERMS

Arteriole (awr-tir´-e-ol)—Any of the small terminal twigs of an artery that ends in capillaries

Venule (ven´-yu{uh}l)—A small vein; any of the minute veins connecting the capillaries with the larger systemic veins

OBJECTIVE 14

Define common disorders and abnormalities associated with the hormones of the adrenal glands.

1. **Addison's disease**—A life-threatening condition caused by partial or complete failure of the function of the adrenal cortex, especially the secretion of aldosterone and the **cortisones**, as well as **melanocyte-stimulating hormone**; the condition is characterized by weakness, nausea, weight loss, increased pigmentation of the skin, irregular milk-white patches on the skin, and water and electrolyte disturbances

KEY TERMS

Cortisone (kor´-tuh-son)—A secretion of the adrenal cortex used especially in the treatment of rheumatoid arthritis

Melanocyte-stimulating (muh-la´-nuh-sit) **hormone** –Either of two hormones of the pituitary gland that darken the skin by stimulating melanin dispersion in pigment-containing cells

2. **Cushing's syndrome**—A metabolic disorder due to the excessive secretion of the hormones of the adrenal cortex caused by increased amounts of a hormone secreted by the pituitary; the disorder is characterized by weakness, increased blood pressure, excess fat in the face, protein loss, **osteoporosis**, **amenorrhea**, **impotence**, and excess hair growth

KEY TERMS

Osteoporosis (aws-te-o-puh-ro´-suhs)—A weakened condition of the bones due to a loss of matrix that is not replaced

Amenorrhea (a-me-nuh-re´-uh)—An absence of menstruation

Impotence (im´-puh-tuhn{t}s)—An inability for a man to become sexually aroused and to perform sexually

OBJECTIVE 15

Complete statements that describe the function of the gonads.

1. **The ovaries (female gonads) secrete several hormones, including estrogens and progesterone.**
2. **Estrogens, such as the hormones estradiol** (es-truh-di´-ol) **and estrone** (es´-tron), **are responsible for female sexual characteristics and for the cyclic changes in the vagina and uterus.**
3. **Progesterone is responsible for the changes in the uterine lining in the second half of the menstrual cycle, for development of the maternal placenta, and for the development of the mammary glands.**
4. **The testes (male gonads) secrete androgens including testosterone** (te-staws´-tuh-ron) **and androsterone, which regulate the development and maintenance of male sexual characteristics.**

OBJECTIVE 16

Describe the common disorders and abnormalities associated with the hormones of the gonads.

- The disorders and abnormalities caused by the hormones secreted by the gonads are a result of either hyposecretion or hypersecretion of a hormone and result in either under- or over-development of the associated sexual characteristic.

OBJECTIVE 17

Complete statements that describe the function of the pancreas (islets of Langerhans).

1. **The islets of Langerhans of the pancreas manufacture the hormones insulin** (in´-suh-luhn) **and glucagon** (glu´-kuh-gawn).
2. **Insulin is necessary for the normal use of glucose in the body and increases the rate of glucose metabolism.**
3. **Decreased production of insulin metabolizes glucose too slowly or not at all, and glucose is excreted in the urine.**
4. **Increased production of insulin metabolizes glucose too fast.**
5. **Glucagon serves as an antagonist to insulin since it accelerates the conversion of glycogen to glucose in the liver.**

KEY TERM

Antagonist (an-ta´-guh-nist)—An agent that works against or in opposition to another agent

✔ **NOTE:** The term *antagonist* comes from the vocabulary of stories, where the antagonist is the person or force that opposes the story's hero or protagonist. In medical terms, an antagonist works in opposition to another agent or force. For example, opposing muscles are antagonistic to each other. The chemical functioning of the body uses many pairs of antagonists to cause actions to occur and then to return the body to homeostasis. In this case, glucagon accelerates the conversion of glycogen to glucose while insulin increases the rate of glucose metabolism.

6. **Glucagon tends to increase the blood-glucose concentration.**

OBJECTIVE 18

Define common disorders and abnormalities associated with the hormones of the pancreas (islets of Langerhans).

1. **Diabetes mellitus** (di-uh-be´-tez me´-luh-tuhs)—A complex disorder of carbohydrate, fat, and protein metabolism that is primarily the result of a relative or complete lack of insulin secretion by the pancreas and is characterized by elevated blood glucose, glucose in the urine, excessive urine production, and excessive thirst

2. **Hypoglycemia** (hi-po-gli-se´-me-uh)—A less-than-normal amount of glucose in the blood usually caused by the administration of too much insulin or excessive secretion of insulin by the islet cells of the pancreas; the condition may result in weakness, headache, hunger, visual disturbances, anxiety, personality changes and, if untreated, delirium, coma, and death

OBJECTIVE 19

Complete statements that describe the function of the pineal body.

1. **The pineal body influences sexual, skeletal, and mental development during the first seven years of life and then becomes inactive.**

2. **The pineal body synthesizes the hormone melatonin** (me-luh-to´-nuhn)**, which exerts an inhibitory effect on the gonads.**

3. **The pineal body is thought to play a role in the disorder called the *seasonal affective disorder*, which is an emotional depression associated with the winter, when the pineal body's secretion of melatonin increases.**

OBJECTIVE 20

Complete statements that describe the function of the thymus gland.

1. **The thymus gland produces hormones that stimulate the production of the small lymphocytes that function in the body's defense against infection, especially in the immune response of newborns.**

2. **The thymus gland secretes a hormone called *thymosin*** (thi´-muh-suhn)**, which promotes the growth of peripheral lymphoid tissue.**

3. **The thymus gland is most active during prenatal life and infancy, and it decreases in size after puberty.**

KEY TERMS

Prenatal (pre-na´-tuhl)—Occurring prior to birth

Puberty (pyu´-buhr-te)—The period of human development when a child becomes sexually mature and capable of reproduction

4. **An enlarged thymus gland in an infant can cause impaired breathing and circulation.**

5. **A person can have the thymus gland removed without serious consequences, but removal of the gland may result in the person having an increased susceptibility to acute infections.**

OBJECTIVE 21

Complete statements that describe the endocrine functions of organs in the body that are not classified as endocrine glands.

1. **Placenta**—The placenta becomes a temporary endocrine gland during pregnancy; it secretes **chorionic gonadotropins**, estrogens, and progesterones at levels that delay menstruation.

KEY TERMS

Chorionic (kor-e-aw´-nik)—Of, relating to, or being part of the **chorion**; secreted or produced by chorionic or related tissue (as in the placenta)

Chorion (kor´-e-awn)—The highly vascular outer embryonic membrane that in placental mammals is associated with the formation of the placenta

Gonadotropin (go-na-duh-tro´-puhn)—A **gonadotropic** hormone

Gonadotropic (go-na-duh-traw´-pik)—Acting on or stimulating the gonads

2. **Stomach**—The stomach secretes gastrin (gas´-truhn) from its walls, which is a hormone that stimulates the secretion of **gastric juice.**

KEY TERM

Gastric (gas´-trik) **juice**—A thin, watery, acidic digestive fluid

3. **Small intestine**—The small intestine secretes secretin (si-kre´-tuhn), which is a hormone that stimulates the secretion of **pancreatic juices** and **bile.**

KEY TERMS

Pancreatic (pan-kre-uh-tek´) **juice**—A clear secretion of pancreatic enzymes that acts on food already acted on by gastric juice and saliva

Bile (bi{uh}l´)—A yellow or greenish fluid secreted by the liver that aids in the absorption of fats

OBJECTIVE 22

Assignment Sheet 1—Practice Critical Thinking: Complete Case Studies that Determine Medical Interventions for Endocrine Disorders

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Answers demonstrate a comprehensive understanding of the information presented in the Information Sheet	_____
• Complete sentences were used in answering each case study	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

The disorders associated with the endocrine system are essentially chemical imbalances in the body—a gland is either secreting the incorrect amount of hormone (too little or too much) or the target cells that normally use the hormone are not able to process the chemical. Obviously, in many cases, there can be great variations in the degree of the chemical imbalance and often the condition will be the result of other specific problems, such as an injury, a genetic defect, or a tumor on the gland. Consequently, a person may be described as being "borderline" diabetic, meaning that the person exhibits some symptoms of diabetes but is not suffering from impaired functioning. Further, endocrine disorders are often referred to as *syndromes* because the condition leads to a set of possible symptoms, some of which may not exhibit themselves or which may appear in varying degrees for different patients.

In this assignment sheet, you will read four case studies that describe patients affected by disorders of the endocrine system. Using resources available in your facility or as directed by your instructor, you will conduct research to determine information about the probable condition and its treatment.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Read each case study below.

_____ 3. Use the information in the Information Sheet and from outside resources to answer the questions in each case study. Use complete sentences in your answers.

_____ 4. Complete the assignment and give it to your instructor for evaluation.

CASE STUDY 1

Charisse Langdon, age 54, has been diagnosed with a tumor on her pituitary gland. She has begun to show signs of osteoporosis and high blood pressure. She shows weight gain in the trunk of her body, though her limbs remain thin. Her face appears to be very swollen and round. What disorder is likely to be affecting this patient, what is the probable cause, and what is the recommended course of treatment?

a. Disorder affecting the patient—_____

_____

b. Probable cause of the disorder— _____

_____

_____

_____

c. Recommended course of treatment— _____

_____

_____

_____

_____

Case Study 2

I-Na Chao, age 34, has been brought into the hospital. The patient is severely dehydrated and in a coma and wears a medical-alert bracelet that indicates that she is an insulin-dependent diabetic. What is the likely cause of her coma and what treatment is required?

a. Probable cause of the coma— _____

_____

_____

_____

_____

b. Recommended course of treatment— _____

_____

_____

_____

_____

Case Study 3

Bert McGraw, age 61, displays drastic swelling of the ventral portion of his neck. His eyes appear to be protruding from their sockets and his entire body appears to be undernourished. He is sweating profusely and has an elevated heart rate. He complains of constant fatigue. What is the condition that he is exhibiting and its probable cause? How should the condition be treated?

a. Disorder affecting the patient— _____

_____

_____

b. Probable cause of the disorder— _____

_____

_____

_____

_____

c. Recommended course of treatment— _____

_____

_____

_____

_____

CASE STUDY 4

George Sanchez, age 28, has collapsed at a job site where he was laying brick. Although he was given something to eat and lots of water at that location, he complains that he feels that he has no strength. When first examined, his skin feels cool and his blood pressure is 86/53. An intern asked if he has been injured because he appears to be in shock, but Mr. Sanchez states that he doesn't remember anything happening to him. One of the doctors calls for a blood test and a urine sample. After some difficulty, Mr. Sanchez provides a urine sample, which shows elevated levels of sodium. What is the disorder? What is likely to be the cause of the patient's symptoms? What treatment should be administered?

a. Disorder affecting the patient—_____

b. Probable cause of the disorder— _____

c. Recommended course of treatment— _____

MODULE SET II:
Major Body Systems

Module 6: Special Senses

1172

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Investigate the Functioning of the Special Senses	25

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 25.
- ❑ 5. **Research** Online resources to learn more about the special senses. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Investigate the Functioning of the Special Senses."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures associated with the special senses and define common disorders and abnormalities associated with the special senses. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *special sense*.
2. Describe the stages in a sensory response.
3. Define the major special senses.
4. Define other senses that may also be associated with the special senses.
5. Define the major layers and cavities of the eye.
6. Complete statements that describe the major muscles of the eye.
7. Define the major structures of the eye.
8. Label the major structures of the eye.
9. Complete statements that describe the sensory response for vision.
10. Define the accessory structures of the eye.
11. Match common disorders and abnormalities of the eye to their correct definitions.
12. Define the major sections of the ear.
13. Describe the types of conduction used to transmit sound within the ear.
14. Define the major structures of the ear that function in sound transmission (hearing).
15. Define the major structures of the ear that function to maintain equilibrium.
16. Describe the function of the branches of the acoustic nerve (cranial nerve VIII).
17. Label the major sections and structures of the ear.
18. Define common disorders and abnormalities of the ear.
19. Complete statements that describe the sensory response for the sense of smell.
20. Define common disorders and abnormalities associated with the sense of smell.

21. Complete statements that describe the sensory response for the sense of taste.
22. Define the common disorder associated with the sense of taste.
23. Label the major structures of the nose and mouth associated with the senses of smell and taste.
24. Complete statements that describe the sensory responses for the senses of touch and pain.
25. Define common disorders and abnormalities associated with the senses of touch and pain.
26. Practice critical thinking: investigate the functioning of the special senses. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *special sense*.

- **Special sense**—The sense of sight, smell, taste, touch, or hearing (see Figure 1)

✔ **NOTE:** Traditionally, we think of the body as having five senses: sight, hearing, smell, taste, and touch. In reality, all sensations occur in the brain as a result of impulses provided by sense receptors all over the body or concentrated in particular areas. You will study the sensory response in Objective 2 and the major special senses in Objective 3.

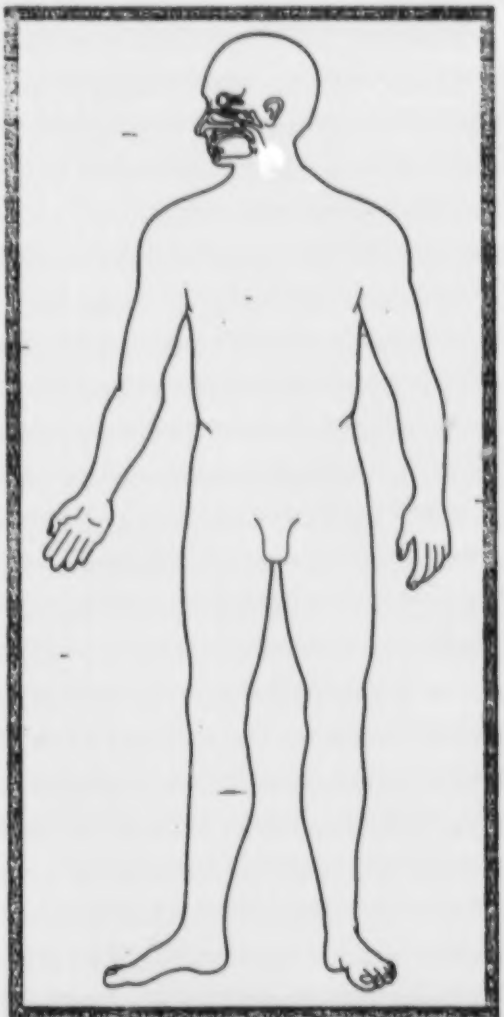


Figure 1
Special senses

OBJECTIVE 2 **Describe the stages in a sensory response.**

1. **Stage 1: Reception—Receptor nerve cells** in a receptor organ (eye, ear, nose, etc.) detect a stimulus and generate a sensory impulse.

> KEY TERM
>
> **Receptor nerve cells**—Specialized nerve cells that react to different types of stimuli
>
> Examples: The cells on the retina of the eye react to light. The neurons in the nose and on the tongue react to chemicals. Nerve cells in the skin respond to energy such as temperature, pressure, and injury (pain).

2. **Stage 2: Transportation**—The **neural** network (sensory nerves) carries the sensory impulse from the receptor to the brain.

> KEY TERM
>
> **Neural** (nur´-uhl)—Relating to a nerve or the nervous system

3. **Stage 3: Sensation**—The appropriate sensory center in the brain receives the sensory impulse and interprets the impulse as a sensation.

   ✔ **NOTE:** Sensations are the outcome of a person's learning the meaning of the interpreted impulse. For example, we must learn the sounds associated with a dog barking or a car racing its engine and the scent of rotten eggs and fresh-baked bread. We learn the tastes of specific foods and determine whether we like them or not—though with changes in our body chemistry and likes and dislikes, we may eventually grow to like a food that we once did not care for.

OBJECTIVE 3 **Define the major special senses.**

1. **Sight**—The visual sense; the special sense that enables the shape, size, position, and color of objects to be perceived; the principal function of the eye

   ✔ **NOTE:** Sight or vision is a sensitivity to light. Light consists of energy of various wavelengths. These differences in wavelength are perceived by humans as different colors called the *visible spectrum.* Some of those wavelengths—referred to as *ultraviolet* and *infrared*—are outside the range of sensitivity of normal human vision. Some persons are sensitive to levels of light intensity (brightness) but cannot recognize colors or cannot distinguish between certain colors, most commonly red and green. You will study the sense of sight in Objective 5 through Objective 11.

2. **Hearing**—The auditory (o´-duh-tor-e) sense; the special sense that enables sound to be perceived; the major function of the ear

   ✔ **NOTE:** You will study the sense of hearing in Objective 12 through Objective 18.

3. **Smell**—The olfactory (awl-fak´-t{uh}-re) sense; the special sense that enables odors to be perceived through the stimulation of the olfactory nerves; the principal function of the nose

   ✔ **NOTE:** You will study the sense of smell in Objective 19, Objective 20, and Objective 23.

4. **Taste**—The gustatory (guhs´-tuh-tor-e) sense; the special sense of perceiving different flavors—sweet, salty, sour, and bitter—in soluble substances that contact the tongue and trigger nerve impulses to special taste centers in the cortex and the thalamus of the brain

   ✔ **NOTE:** Much of what people often associate with the sense of taste is actually sensed through smell. You will study the sense of taste in Objective 21 through Objective 23.

5. **Touch**—The tactile (tak´-tuhl) sense; the ability to feel objects and to distinguish their various physical characteristics; the ability to perceive pressure when it is exerted on the skin

   ✔ **NOTE:** Various other characteristics are associated with the sense of touch and the skin. They are pressure, heat, cold, and pain. You will study the sense of touch in Objective 24 and Objective 25.

OBJECTIVE 4 **Define other senses that may also be associated with the special senses.**

1. **Hunger**—A craving or urgent need for food

   ✔ **NOTE:** The hypothalamus (hi-po-thuh´-luh-muhs) is the part of the brain that activates and controls appetite.

2. **Thirst**—A perceived desire for water or fluid

   ✔ **NOTE:** Thirst is usually sensed in the mouth and throat, but the hypothalamus is the part of the brain that activates and controls thirst.

3. **Equilibrium** (e-kwuh-li´-bre-uhm)—The sense of balance; the awareness of body position and changes in body position

   ✔ **NOTE:** The sense of equilibrium is a function of the ear.

4. **Proprioception** (pro-pre-o-sep´-shuhn)—The sensation pertaining to stimuli originating from within the body regarding spatial position

   ✔ **NOTE:** The muscles contain muscle spindles called *proprioceptors* (pro-pre-o-sep´-tuhrz) that detect the stretching of the muscles that allow the brain to form an image of the positioning of body parts relative to each other. This sense is also referred to as *muscle sense* or *kinesthetic sense*.

OBJECTIVE 5

Define the major layers and cavities of the eye (see Figure 2 on page 12).

1. **Layers**

   - **Sclera** (skler´-uh)—The dense, fibrous, opaque, white outer coating that encloses and protects the inner eye

     ✔ **NOTE:** The sclera is commonly referred to as the *white of the eye.*

   - **Choroid** (kor´-oid) **coat**—The thin, highly vascular middle membrane containing large branched pigmented cells; this layer provides the blood supply for the entire eye, and the pigmented cells prevent extraneous light from entering the inside of the eye

   - **Retina** (re´-tuhn-uh)—The 10-layered, delicate nervous-tissue membrane of the eye that is continuous with the optic (awp´-tik) nerve, receives images of external objects, and transmits visual impulses through the optic nerve to the brain

     ✔ **NOTE:** You will study the optic nerve in Objective 7.

2. **Cavities**

   - **Anterior cavity**—The cavity of the eye in front of the iris (i´-ruhs); the cavity that contains the **aqueous humor**

     ✔ **NOTE:** You will study the iris in Objective 7.

KEY TERMS

Aqueous (a´-kwe-uhs)—Of, relating to, or resembling water

Humor (hyu´-muhr)—A body fluid

Aqueous humor—The watery, transparent fluid occupying the anterior cavity of the eye; it provides nourishment for the crystalline lens and the cornea

✔ **NOTE:** Aqueous humor is continuously produced and is drained from the eye by way of a small opening called the *canal of Schlemm.* If aqueous humor fails to drain from the eye, glaucoma (glau-ko´-muh) results. You will study glaucoma in Objective 11.

   - **Vitreous cavity**—The cavity in the eye posterior to the crystalline (kris´-tuh-luhn) lens; the cavity that contains the **vitreous humor**

     ✔ **NOTE:** You will study the crystalline lens in Objective 7.

KEY TERMS

Vitreous (vi´-tre-uhs)—Resembling glass

Vitreous humor—The clear, colorless, transparent, jelly-like fluid that fills the vitreous cavity of the eye

OBJECTIVE 6

Complete statements that describe the major muscles of the eye.

1. **Extrinsic muscles**

   - The term *extrinsic muscles* refers to the muscles of the eye that are attached to the outside of the eyeball and to the bones of the **orbit**.
   - The extrinsic muscles are voluntary muscles that move the eyeballs and coordinate the muscles of the separate eyes in order to focus vision.

KEY TERMS

Extrinsic (ek-strin´-zik)—Originating outside a part and acting upon the part as a whole

Orbit (or´-bit)—One of a pair of bony, conical cavities in the skull that accommodate the eyeballs and associated structures

2. **Intrinsic muscles**

   - The term *intrinsic muscles* refers to the muscles of the eye that are located within the body of the eye.
   - The intrinsic muscles consist of two involuntary muscles: the iris and the ciliary muscle, which adjust the amount of light entering the eye and allow the eyes to focus on objects at varying distances.

     ✔ **NOTE:** You will study the iris and the ciliary muscle in the next objective.

KEY TERM

Intrinsic (in-trin´-zik)—Originating and including wholly within an organ or part

OBJECTIVE 7

Define the major structures of the eye (see Figure 2 on the next page).

1. **Conjunctiva** (kawn-juhn{k}-ti´-vuh)—The mucous membrane that lines the inner surfaces of the eyelids and continues over the anterior part of the sclera
2. **Cornea** (kor´-ne-uh)—The transparent part of the sclera that passes in front of the crystalline lens and allows light to enter the inner eye
3. **Crystalline lens**—The transparent structure of the eye that is enclosed in a capsule situated between the iris and the vitreous humor; it refracts light to focus images on the retina
4. **Suspensory** (suh-spen´-suh-re) **ligament**—The ringlike, fibrous membrane that connects the ciliary muscle and the crystalline lens of the eye and holds the lens in place

5. **Iris**—The pigmented part of the choroid layer that produces the eye color and functions as a sphincter

   ✔ **NOTE:** The hole in the center of the iris is called the *pupil.* By changing size, the pupil regulates the amount of light entering the eye.

6. **Ciliary** (si´-le-er-e) **muscle**—The semitransparent, circular band of smooth muscle fibers attached to the choroid coat of the eye; the chief agent in adjusting the eye to view near objects

   ✔ **NOTE:** The ciliary muscles relax and contract to alter the shape of the crystalline lens, making it thicker or thinner and allowing light to focus on the retina, a process called *accommodation.*

7. **Optic nerve**—Either of the pair of nerves that comprise the second pair of cranial nerves, supply the retina, and conduct visual stimuli to the brain

OBJECTIVE 8 **Label the major structures of the eye** (see Figure 2).

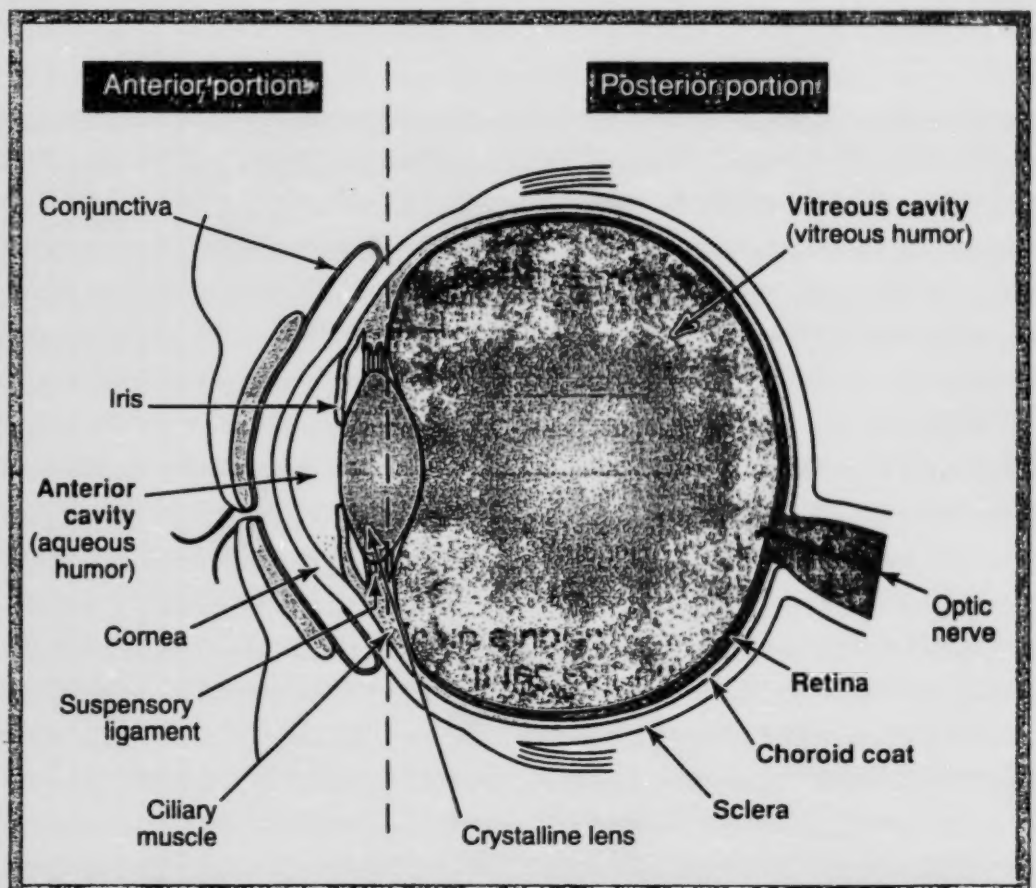


Figure 2
Major structures of the eye

OBJECTIVE 9

Complete statements that describe the sensory response for vision.

1. **The iris functions as a sphincter; by changing the size of the pupil, the iris regulates the amount of light entering the eye.**
2. **The vitreous humor, crystalline lens, and aqueous humor are the structures of the eye that bend the light rays and focus them on the retina.**
3. **The retina contains two types of visual receptors: rods and cones.**
4. **Rods function in dim light and produce black-and-white vision.**
5. **Cones function in bright light and produce color vision.**
6. **When stimulated, the rods and cones produce sensory impulses; the sensory impulses are transported to the optic nerve.**
7. **The optic nerve transports the sensory impulses to the brain; the brain interprets the sensory impulses as vision.**

OBJECTIVE 10

Define the accessory structures of the eye.

1. **Eyebrow**—The arch of hairs growing along the ridge formed by the supraorbital arch of the frontal bone
2. **Eyelash**—One of many cilia growing in triple rows along the border of the eyelids

   ✔ **NOTE:** The eyebrows and the eyelashes help protect the eye against the entry of foreign objects.
3. **Eyelid**—A movable fold of thin skin over the eye, consisting of loose connective tissue containing a thin plate of fibrous tissue lined with mucous membrane

   ✔ **NOTE:** The eyelids open and close as a result of stimuli such as foreign objects and light.
4. **Lacrimal gland**—One of a pair of small, almond-shaped glands located in the upper, outer portion of each orbit, which secretes tears that keep the anterior surface of the eye moist and free from irritating particles (see Figure 3 on the next page)

KEY TERM

Lacrimal (la-kruh´-muhl)—Of or pertaining to tears

5. **Lacrimal duct**—One of about 10 ducts that run beneath a lacrimal gland to pass tears through the conjunctiva

   ✔ **NOTE:** After the tears wash over the eyeball, they collect at the inner edge of the eye (see Figure 3 on the next page).
6. **Lacrimal canal**—One of two ducts in each eye that is located at the inner edge of the eye and allows tears to leave the eye and wash into the lacrimal sac (see Figure 3 on the next page)

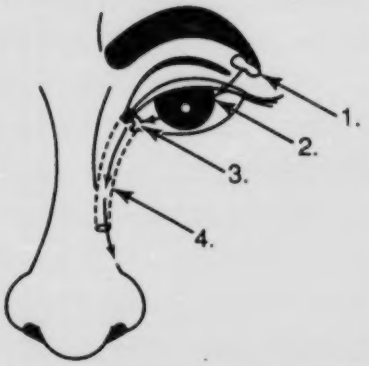
7. **Lacrimal sac**—The large, rounded, closed end of the **naso**lacrimal duct

KEY TERM

naso- (na-zo´-)—Pertaining to the nose

8. **Nasolacrimal duct**—The duct that extends into the nasal cavity (see Figure 3)

✔ **NOTE:** Collectively, the lacrimal gland, ducts, canals, sac, and nasolacrimal duct are called the *lacrimal apparatus*.



1. The lacrimal gland releases tears into the eye via the lacrimal ducts.
2. Tears wash over the eyeball.
3. Tears leave the eye via the lacrimal canals.
4. Tears wash into the lacrimal sac and then into the nasolacrimal duct that leads into the nasal cavity.

Figure 3
Lacrimal apparatus

OBJECTIVE 11 **Match common disorders and abnormalities of the eye to their correct definitions.**

✔ **NOTE:** The primary disorders of the eye are those that prevent proper vision, usually because of physical defects in the eyes, such as a lens that is cloudy or that will not focus properly. Many of these disorders can be compensated for by surgery or through mechanical means such as eyeglasses or contact lenses.

1. **Cataract** (ka´-tuh-rakt)—An abnormal, progressive condition of the crystalline lens of the eye that is characterized by the loss of transparency

2. **Myopia** (mi-o´-pe-uh)—Nearsightedness, a condition caused by the elongation of the eyeball or by an error in refraction so that the light rays entering the eye are focused in front of the retina

3. **Hyperopia** (hi-puhr-o´-pe-uh)—Farsightedness, a condition caused by the shortening of the eyeball or by an error in refraction so that the light rays entering the eye are focused behind the retina

✔ **NOTE:** In myopia, near objects can be seen well but distant objects cannot. In hyperopia, distant objects can be seen well but near objects cannot.

4. **Astigmatism** (uh-stig´-muh-ti-zuhm)—A condition caused by abnormal curvature of the cornea or crystalline lens so that light rays cannot be focused clearly in a point on the retina

   ✔ **NOTE:** With astigmatism, vision is blurred and the use of the eyes causes a person discomfort.

5. **Glaucoma** (glau-ko´-muh)—An abnormal condition of elevated pressure within an eye that is caused by the obstruction of the outflow of aqueous humor

   ✔ **NOTE:** Glaucoma can lead to blindness.

6. **Color blindness**—An abnormal condition characterized by an inability to clearly distinguish the colors of the spectrum

   ✔ **NOTE:** Light is an electromagnetic energy that travels in waves of varying lengths. The total collection of wavelengths is referred to as the *light spectrum*. The eyes are sensitive to a portion of the spectrum referred to as *visible light*. The wavelengths in the visible spectrum are perceived as colors ranging from red through orange, yellow, green, blue, indigo, and violet.

   There are two forms of color blindness. The most-common form—daltonism—is characterized by an inability to distinguish reds from greens. It is an inherited, sex-linked disorder. The second form—total color blindness—is characterized by an inability to perceive any color at all. Only white, gray, and black are seen. It may be a result of a defect in or the absence of cones in the retina.

7. **Nyctalopia** (nik-tuh-lo´-pe-uh)—Night blindness; poor vision at night or in dim light

   ✔ **NOTE:** The pupil dilates to allow more light into the eye as the light level decreases. However, below a certain intensity of light, the eye is not able to perceive light. Persons who suffer from night blindness require greater intensities of light than required by most persons. This condition is generally associated with a deficiency in vitamin A.

8. **Conjunctivitis** (kuhn-juhn{k}-ti-vi´-tuhs)—An inflammation of the conjunctiva caused by bacterial or viral infection, allergy, or environmental factors and characterized by red eyes, a thick discharge, sticky eyelids in the morning, and inflammation without pain

9. **Trachoma** (truh-ko´-muh)—A chronic, contagious bacterial conjunctivitis characterized by inflammatory granulations that, if left untreated, form follicles on the upper eyelids and grow larger until the granulations invade the cornea, eventually causing blindness

   ✔ **NOTE:** Trachoma is caused by Chlamydia (kle-mi´-de-uh) trachomatis bacterium.

10. **Retinal detachment**—A separation of the retina from the choroid in the back of the eye, usually resulting from a hole in the retina that allows the vitreous humor to leak between the choroid and the retina

    ✔ **NOTE:** A retinal detachment may be the result of a trauma to the eye, but in most cases, it is the result of internal changes in the vitreous cavity associated with aging or inflammation of the interior eye.

OBJECTIVE 12 **Define the major sections of the ear** (see Figure 4 on page 18).

✔ **NOTE:** Hearing is the result of sound waves being directed into the interior of the ear and causing vibrations that are detectable by the auditory nerves. The ear consists of an external portion that directs sound waves into the inner ear. The inner ear converts sound-wave vibrations into nerve signals. Auxiliary structures in the ear assist in performing other functions.

1. **External ear**—The outer portion of the ear that consists of the auricle (or´-i-kuhl) and the portion of the external auditory canal that is outside the skull

   ✔ **NOTE:** You will study the auricle and the external auditory canal in Objective 14.

2. **Middle ear**—The central portion of the ear consisting of the tympanic (tim-pa´-nik) cavity and the auditory ossicles (aw´-si-kulz) contained in an irregular space in the temporal bone; it is separated from the external ear by the tympanic membrane and from the inner ear by the oval window

   ✔ **NOTE:** The ossicles of the middle ear are the malleus, the incus, and the stapes. You will study the tympanic membrane and the oval window in Objective 14.

3. **Inner ear** (internal ear, labyrinth)—The complex inner structure of the ear that contains the receptors that help maintain equilibrium and that translate sound vibrations into impulses for the sense of hearing

   ✔ **NOTE:** You will study the structures of the inner ear in Objective 14 and Objective 15.

OBJECTIVE 13 **Describe the types of conduction used to transmit sound within the ear.**

1. **Air conduction**—Sound waves are scooped up by the auricle and travel on the air in the external auditory canal to the tympanic membrane

2. **Bone conduction**—Sound waves are changed to sound vibrations at the tympanic membrane, and the vibrations are conducted through the middle ear by the three bones—the malleus, incus, and stapes

3. **Fluid conduction**—Sound vibrations are carried by the fluid in the cochlea (ko´-kle-uh) of the inner ear, which contains the hearing receptors that convert the vibrations to nerve impulses

OBJECTIVE 14 **Define the major structures of the ear that function in sound transmission (hearing)** (see Figure 4 on page 18).

1. **Auricle** (pinna [pi´-nuh])—The skin-covered cartilaginous portion of the external ear that is visible on either side of the head; the structure collects sound waves traveling through the air and channels them to the external auditory canal

2. **External auditory canal** (ear canal, external auditory meatus)—The slender, tubelike passageway of the external ear that is lined with ceruminous (suh-ru´-muh-nuhs) glands; the structure funnels sound waves from the external ear to the structures of the middle ear

✔ **NOTE:** The ceruminous glands secrete cerumen (suh-ru´-muhn), the substance commonly called *earwax*—a soft, sticky substance that traps foreign particles from the outside.

3. **Tympanic membrane**—The thin membrane located at the end of the external auditory canal that marks the beginning of the middle ear and functions to transmit sound vibrations to the inner ear by means of the ossicles; also called the *eardrum*

✔ **NOTE:** Sound waves that enter the external auditory canal strike the tympanic membrane and cause it to vibrate. The ossicles pick up the vibrations.

4. **Malleus** (ma´-le-uhs)—The hammer-shaped ossicle of the middle ear that is attached to the tympanic membrane and transfers sound vibrations from the tympanic membrane to the incus

5. **Incus** (in´-kuhs)—The anvil-shaped ossicle of the middle ear that is attached to the malleus and transfers sound vibrations to the stapes

6. **Stapes** (sta´-pez)—The stirrup-shaped ossicle of the middle ear that is attached to the incus and transfers sound vibrations to the inner ear

7. **Oval window**—An oval-shaped, membrane-covered opening on the external surface of the cochlea that is connected to the stapes

8. **Cochlea**—The snail-shaped structure of the inner ear that is filled with fluid; sound vibrations transferred from the stapes cause the stapes to bump against the oval window; the stimulation of the oval window then causes the fluid in the cochlea to move

9. **Organ of Corti**—A spiral structure within the cochlea that contains hair cells (hairs of Corti) that are stimulated by sound vibrations; the hair cells convert the vibrations into nerve impulses that are transmitted by the acoustic nerve (cranial nerve VIII) to the brain

10. **Eustachian** (yu-sta´-sh{e}-uhn) **tube** (auditory tube)—The bony and cartilaginous tube that connects the middle ear to the nasal passages in order to equalize the air pressure in the middle ear with atmospheric pressure and produce proper vibrations

✔ **NOTE:** The pressure on each side of the tympanic membrane must be equalized to produce proper vibrations. Changes in altitude, such as driving in the mountains or traveling in an airplane, expose the ear to changes in pressure because air pressure decreases with increased altitude. A person may sense these changes as "popping of the ears."

OBJECTIVE 15 **Define the major structures of the ear that function to maintain equilibrium** (see Figure 4 on the next page).

1. **Vestibule**—The central portion of the inner ear that joins the cochlea and the semicircular canals and assists with the sensations of position and movement

2. **Semicircular canals**—The three bony, fluid-filled loops of the inner ear that open into the cochlea and contain the receptors for equilibrium

OBJECTIVE 16 **Describe the function of the branches of the acoustic nerve (cranial nerve VIII)** (see Figure 4 below).

1. **Cochlear branch**—Serves as the pathway to the brain for the transport of nerve impulses for sound
2. **Vestibular branch**—Serves as the pathway to the brain for the transport of the nerve impulses for balance/equilibrium

OBJECTIVE 17 **Label the major sections and structures of the ear** (see Figure 4).

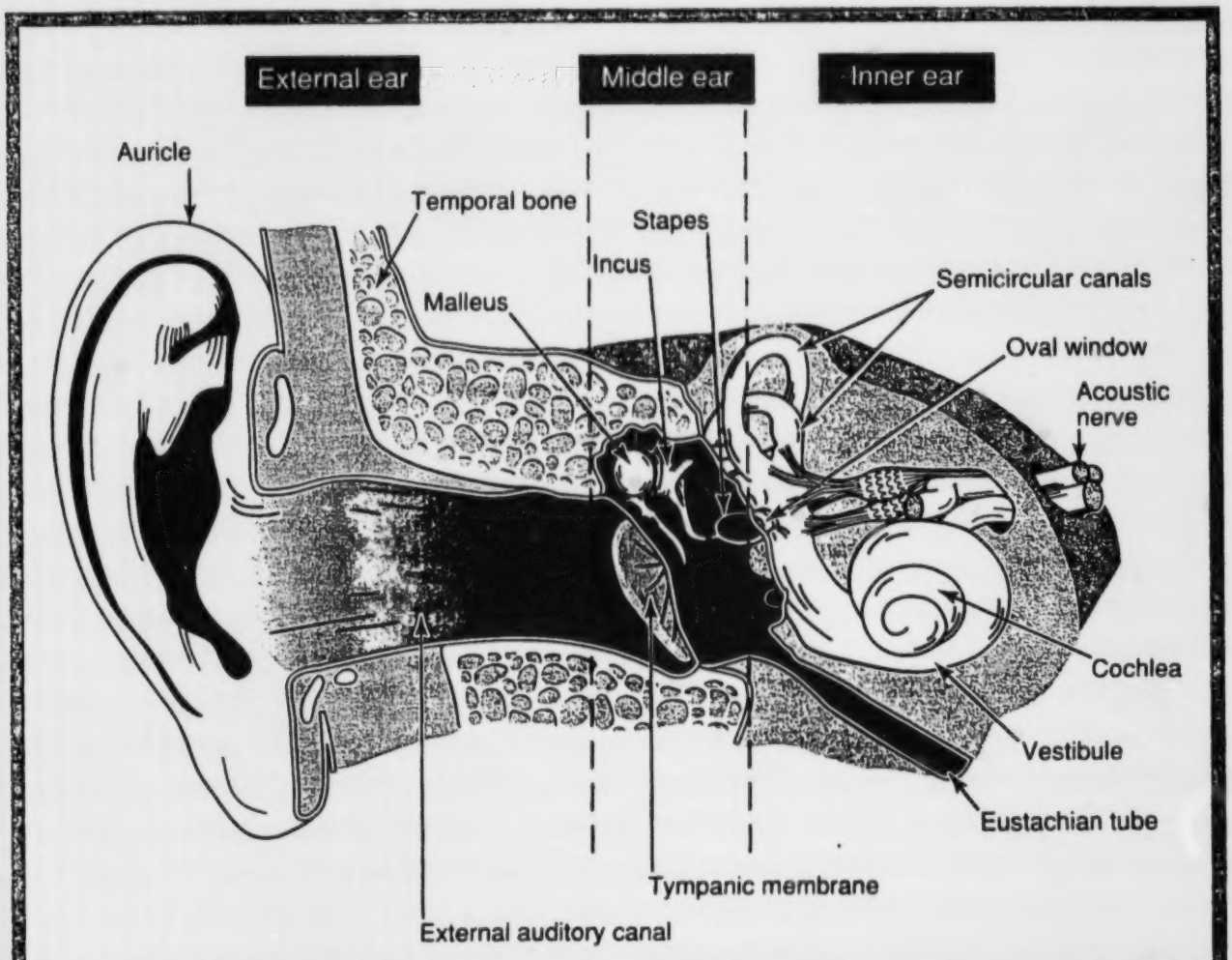


Figure 4
Major sections and structures of the ear

OBJECTIVE 18

Define common disorders and abnormalities of the ear.

✔ **NOTE:** Hearing problems are generally a result of impaired nerve functioning or impaired conduction of sound vibrations. Nerve impairment may occur in the auditory receptors, the auditory nerve, or the sensory region of the brain. If the condition leads to complete loss of hearing, the result is termed *deafness*, while the term *partial deafness* means that the loss of hearing is not complete.

1. **Otosclerosis** (o-to-skluh-ro´-suhs)—An inherited bone disorder that causes a deformity of the stapes that causes **tinnitus** and then deafness

   ✔ **NOTE:** The deafness is usually noticed between the ages of 11 and 30 years, and women are affected twice as often as men.

KEY TERM

Tinnitus (ti´-nuh-tuhs)—A sensation of ringing in the ear

2. **Otitis externa**—An inflammation or infection of the external auditory canal or the auricle usually caused by allergy, bacteria, fungi, viruses, or trauma

KEY TERM

Otitis (o-ti´-tuhs)—An inflammation or infection of the ear

3. **Otitis media**—An inflammation or infection of the middle ear that is common during childhood; is usually caused by bacteria, virus, or allergy; and is often preceded by an upper-respiratory infection

4. **Presbycusis** (prez´-be-kyu-suhs)—A loss of hearing sensitivity and speech intelligibility that is associated with aging

KEY TERM

presby- (prez´-be-)—A combining form meaning "pertaining to aging or being elderly"

5. **Mènière's** (muhn-yerz´) **disease**—A condition with an unknown cause that is characterized by **vertigo**, progressive hearing loss, tinnitus, and a sensation of pressure within the ear

   ✔ **NOTE:** The sounds that we hear are the result of vibrations that travel through the air or other conducting material. The pattern of these vibrations is a series of connected waves, similar to the ripples that are generated on the surface of a pond when a stone is tossed into it. One of the characteristics of these sound waves is referred to as *frequency*. As the name implies, frequency refers to the spacing of the waves, or how frequently the waves arrive. This does not mean how fast the sound is traveling because under the same circumstances, such as conducting material and

temperature, all sounds will travel at the same speed—roughly 738 miles per hour (1185 kilometers per hour). Instead, frequency describes the spacing between the peaks of the waves. The closer the peaks are to each other, the greater the frequency and the higher the pitch of the sound. Thus, a person who speaks in a deep voice produces sounds of a lower frequency than someone who speaks in a higher voice. Normal hearing in humans ranges from about 20 cycles (waves) per second to about 20,000 cycles per second. Hearing loss, such as that associated with Mènière's disease, often involves reduced sensitivity to one or the other extreme in frequency.

KEY TERM

Vertigo (vuhr´-ti-go)—A sensation of the entire body spinning that is often caused by impairment of the equilibrium mechanism

6. **Cerumen impaction** (im-pak´-shuhn)—A buildup of hardened cerumen that can interfere with the normal functioning of the ear

OBJECTIVE 19

Complete statements that describe the sensory response for the sense of smell (see Figure 5 on page 22).

1. **The olfactory nerve (cranial nerve I) is composed of fine filaments that are located in the olfactory membrane—the mucous membrane of the superior turbinate of the nasal cavity.**

KEY TERMS

Turbinate (tuhr´-buh-nuht)—One of several thin, **plicated** membrane-covered bony or cartilaginous plates on the walls of the nasal cavity

Plicated (pli´-kat-uhd)—Folded lengthwise like a fan

2. **The olfactory nerve connects with the olfactory bulb and the olfactory tract, which are components of the portion of the brain associated with the sense of smell.**

OBJECTIVE 20

Define common disorders and abnormalities associated with the sense of smell.

✔ **NOTE:** The sense of smell in humans is most sensitive between the ages of 30 and 60 years, after which the sense begins to decline so that many of the elderly eventually lose their sense of smell. The sense of smell in women is usually more accurate than in men.

1. **Anosmia** (a-nawz´-me-uh)—A loss or impairment of the sense of smell

   ✔ **NOTE:** A loss or impairment of the sense of smell usually occurs as a temporary condition resulting from a head cold or respiratory infection or when intranasal swelling or other obstruction prevents odors from reaching the olfactory region. Two primary causes can lead to a loss of the sense of smell—a physical disruption or a chemical disruption of the sense receptors or of the nerve pathway. Respiratory problems,

polyps in the nose or sinuses, or injury to the head or throat, including as a result of radiation therapy, can interfere with the sense of smell. Exposure to chemicals, medications, tobacco smoking, and certain illnesses can lead to chemical interference in the sense of smell.

2. **Hyperosmia**—An abnormally increased sensitivity to odor

OBJECTIVE 21 **Complete statements that describe the sensory response for the sense of taste** (see Figure 5 on the next page).

1. **The receptors for taste are the taste buds, which are located in the papillae of the tongue.**

KEY TERM

Papilla (puh-pi´-luh)—Any of the small projections on the upper surface of the tongue

2. **The receptors for salty taste and for sweet taste are localized near the tip of the tongue.**
3. **The receptors for sour taste are localized along each side of the tongue.**
4. **The receptors for bitter taste are localized near the back of the tongue.**
5. **The receptors for taste are connected to the branches of cranial nerve VII and cranial nerve IX.**

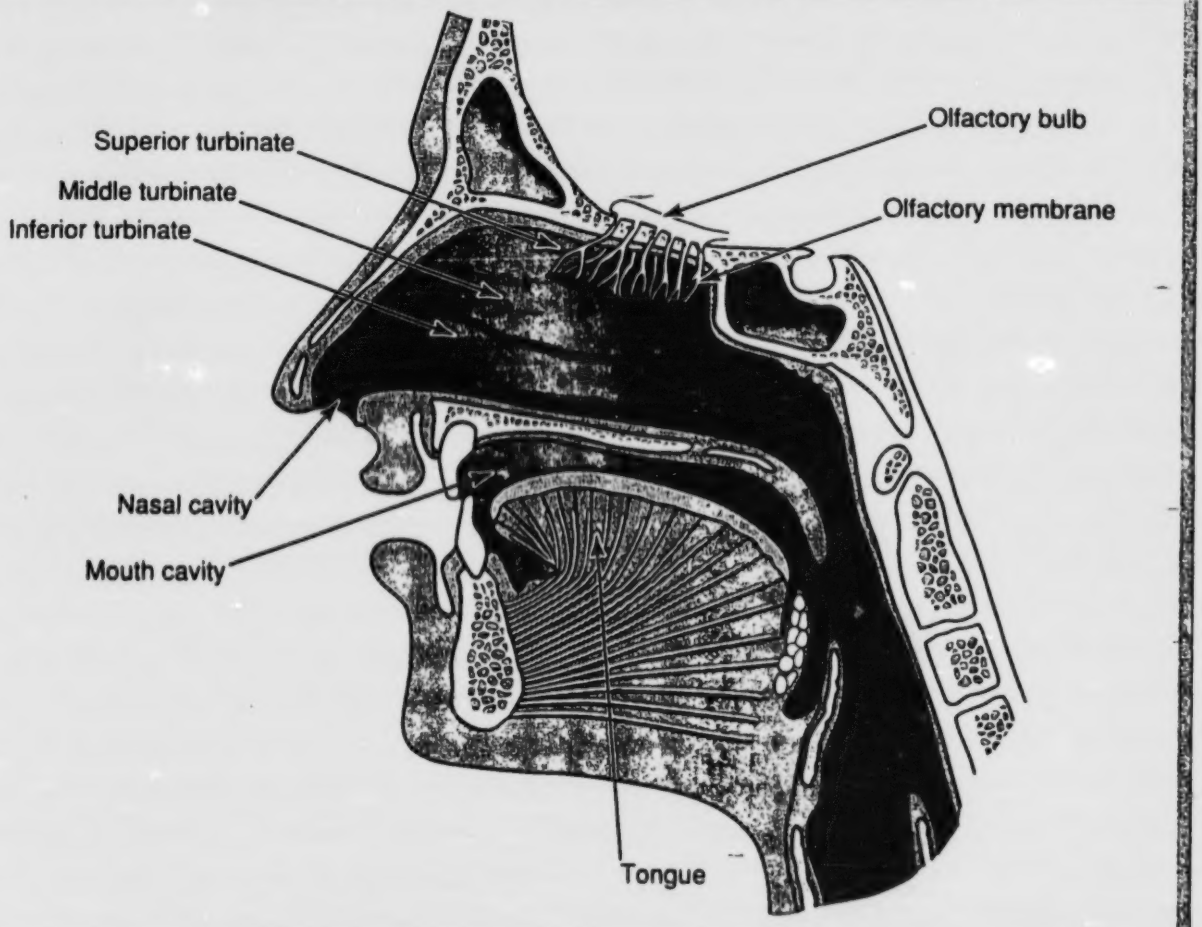
OBJECTIVE 22 **Define the common disorder associated with the sense of taste.**

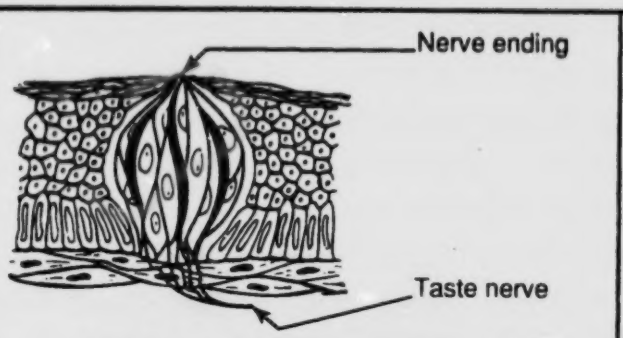
✔ **NOTE:** Because of the interrelationship between the senses of smell and taste, many of the conditions that will lead to a loss of the ability to sense odors will also create a loss in the sense of taste. Losses or reductions in the ability to taste may be general or may affect only one type of taste, such as sweet or sour.

■ **Ageusia** (uh-goo´-ze-uh)—A loss or impairment of the sense of taste

✔ **NOTE:** A reduced sense of taste may be called *hypogeusia*.

OBJECTIVE 23 | **Label the major structures of the nose and mouth associated with the senses of smell and taste** (see Figure 5).





Enlarged view of a taste bud

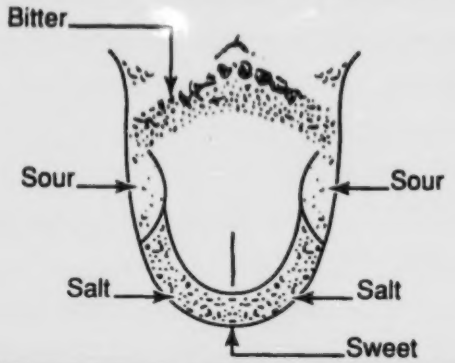


Figure 5
Major structures of the nose and mouth that are associated with the senses of smell and taste.

OBJECTIVE 24

Complete statements that describe the sensory responses for the senses of touch and pain.

✔ **NOTE:** While it is convenient to distinguish among the types of sensory receptors located in the skin, in reality they are widely scattered in the skin and function in conjunction with one another. For example, if someone laid a heated bar of polished steel across the back of your arm, you would immediately have a sense of its smoothness, its weight, and its warmth, even though those sensations would be reported by a variety of receptors. If the bar is particularly heavy or excessively warm, you would also experience pain.

1. **Touch is sensed by receptors of sensory dendrites that are located in the skin.**
2. **Some touch receptors provide information about the texture of the object being touched and some receptors provide information about the amount of pressure being exerted against or by the object being touched.**
3. **Receptors in the skin also sense the temperature of the air surrounding the body or the temperature of objects the skin contacts.**
4. **Nociceptors** (no-si-sep´-tuhrz) **located in the skin and viscera sense pain to provide a warning of potentially harmful conditions.**
5. **Pain is classified as somatic pain, visceral pain, and referred pain.**
6. **Somatic pain is sensed in the skin and can be superficial or deep.**
7. **Visceral pain is sensed in the internal organs.**
8. **Referred pain is pain that exists in an internal organ or deep structure but is felt in another region.**

OBJECTIVE 25

Define common disorders and abnormalities associated with the senses of touch and pain.

✔ **NOTE:** A loss of the sense of touch is referred to as *numbness*. Numbness may be complete or partial. The two primary causes of numbness are (1) destruction of the receptors or the nerve pathway or (2) a condition that interferes with the normal functioning of the receptors and nerve pathways. For example, a person may lose sensory receptors in the skin if he or she is severely burned. Poor blood circulation, as when your foot goes to "sleep," prolonged use of a body part, chemical blockers such as anesthetics, and other factors may prevent sensations of touch and pain. These conditions may be temporary or permanent. In some cases, they may start as a temporary condition but become permanent if the causative factor is not eliminated.

1. **Raynaud's** (ra´-noz) **syndrome**—Intermittent attacks to the extremities of the body—especially the fingers, toes, ears, and nose—that are characterized by numbness, tingling, burning, and often pain

   ✔ **NOTE:** Raynaud's syndrome is sometimes referred to as *white finger* due to the loss of color in the skin and muscles, which are unable to get adequate oxygen from the blood and eventually die. Other symptoms include tingling in the fingers and a lack of normal warmth in the fingers and hands.

KEY TERM

Syndrome (sin´-drom)—A set of symptoms that together characterize an abnormal condition

2. **Carpal-tunnel syndrome**—A condition caused by compression of the median nerve where it passes through the wrist into the hand, leading to a sensation of tingling, numbness, or severe pain in the wrist and hand

   ✔ **NOTE:** The median nerve extends down the arm to the hand and provides the sense of touch in the thumb, index finger, middle finger, and half of the ring finger. It extends through the carpal tunnel, which is formed by the tendons of the wrist. Repetitive motions, injury, or illness can cause the tendons to swell, exerting pressure on the median nerve. This pressure produces the symptoms of the syndrome, often during the night. Carpal-tunnel syndrome can result in a lack of strength in the hand and the inability to make a fist or grip objects. The condition can damage the median nerve so severely that there is a permanent loss of sensation or even partial paralysis.

3. **Thoracic-outlet syndrome**—A condition caused by compression of the nerves and blood vessels between the neck and shoulders

   ✔ **NOTE:** Thoracic-outlet syndrome is similar to carpal-tunnel syndrome and is generally the result of injury or excessive exertion involving the neck and shoulders.

OBJECTIVE 26

Assignment Sheet 1—Practice Critical Thinking: Investigate the Functioning of the Special Senses

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Case-study presentation followed agreed-upon format	_____
• Case-study presentation met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

What we know about the world around us is based primarily on the information that we receive from our senses. The receptors of the special senses send information over nerve pathways to the sensory centers of the brain. Based on past experiences, the brain analyzes the information and makes conclusions that may lead to other responses. For example, eating a piece of chocolate may lead to feelings of pleasure and a desire for more. Touching a hot object may lead to a sense of pain and cause one to pull his or her hand away.

Yet those senses are not infallible. Disease, injury, chemical imbalances (such as drugs or alcohol), fatigue, over-stimulation, and other factors may lead to incorrect assumptions about our environment. Even the normal functioning of the special organs may lead to incorrect conclusions. As your understanding of anatomy and physiology increases, reasons for the potential misinterpretation of sensory inputs should become more apparent to you. In this assignment sheet, you will have an opportunity to explore the functioning of the special sense organs and interpret reasons for the performance of the sense organs.

In this assignment sheet, you will be provided with examples of sensory events. You will be asked to interpret what is happening in these events. Based on what you know about the anatomy and physiology of the special sense organs and using other resources available in your facility, you will answer the questions provided with each case study.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Study the five case studies below.

_____ 3. You must complete at least three of the case studies. Check with your instructor to determine which of the following five case studies you will complete. Write the numbers of those case studies on the blank line below.

_____ 4. Check with your instructor to determine the format (written report, Power Point presentation, poster, etc.) your instructor wants you to follow in presenting your case studies. Describe that format on the blank lines below.

_____ 5. Check with your instructor to agree upon the evaluation criteria he or she will use to evaluate your case-study presentation. Describe those criteria on the blank lines below.

_____ 6. Complete your case-study presentation and return it to your instructor for evaluation.

Case-study numbers _____

Format of case-study presentation _____

_____

_____

_____

_____

_____

_____

Evaluation criteria for case-study presentation _____

_____

_____

_____

_____

_____

_____

Case Study 1

You may have noticed that at night you may catch a glimpse of an object out of "the corner of your eye" that is harder to see when you look at it directly. For example, locate a moderately bright star in the nighttime sky. Look at it and then shift your line of sight slightly to one side of that star. You will probably find that the star appears brighter than when you looked at it directly. What anatomical fact would explain this?

Case Study 2

This case study requires you to conduct an experiment involving the objects in Figure 1 below. Close your left eye and hold the page approximately 12 inches (35 centimeters) from your face. Stare at the diamond with your right eye and slowly move the page closer to your face. At some point, the circle should disappear and then reappear as you continue to move the page toward your face. What is the anatomical explanation for this phenomenon?

Figure 1

Case Study 3

You have probably experienced the sensation of dizziness. What causes this sensation and why is it harder to recover from the sense of being dizzy if you have your eyes closed?

Case Study 4

A lot of elderly persons suffer from poor nutrition. The reasons for this are numerous, including the inability or unwillingness to cook nutritious meals and the declining abilities of the digestive system to process nutrients. What factors related to the special senses may also contribute to this condition?

Case Study 5

Amputees often experience pain and other sensations of the severed limb. This is referred to as *phantom pain*. The sensations are very real to the amputee. Soon after the amputation, it may be difficult to convince a patient that the limb has been removed because he or she is so convinced that the sensations are in the missing part, that he or she can feel the movement of the limb, sense pain and itches, and feel temperature and pressure. Based on your understanding of the physiology of special senses and the nervous system, what is your explanation of phantom pain?

MODULE SET II:
Major Body Systems

Module 7: Circulatory System—Blood

1199

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Complete Case Studies on the Role of Blood in Maintaining Good Health	21

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 18.
- ❑ 5. **Research** Online resources to learn more about the circulatory system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Complete Case Studies on the Role of Blood in Maintaining Good Health."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

Module Objective

After completing this module, you should be able to list the subsystems of the circulatory system, define the major organs of the circulatory system, describe the major constituents and physical characteristics of blood, and define common disorders and abnormalities of the blood. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

Specific Objectives

After completing this module, you should be able to

1. Define the term *circulatory system*.
2. State the functions of the circulatory system.
3. List the subsystems of the circulatory system.
4. Match the major organs of the circulatory system to their correct definitions.
5. Define the major components of blood.
6. Complete statements that describe the normal physical characteristics of blood.
7. List the major components of blood plasma.
8. Complete statements that describe the characteristics of erythrocytes.
9. Complete statements that describe the characteristics of leukocytes.
10. Complete statements that describe the characteristics of thrombocytes.
11. Define the term *hematology*.
12. Define common tests used in hematologic studies.
13. State the normal parameters of the common tests used in hematologic studies.
14. Complete statements that describe the characteristics of the Rh blood-group factor.
15. Complete statements that describe the characteristics of the human blood groups (blood types).
16. Describe the factors that must be considered when blood is matched for a transfusion.
17. Complete statements that describe the blood-clotting process (blood coagulation).
18. Match common disorders and abnormalities of the blood to their correct definitions.
19. Practice critical thinking: complete case studies on the role of blood in maintaining good health. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *circulatory system.*

■ **Circulatory system**—The network of channels through which the nutrient fluids of the body circulate (see Figures 1-a and 1-b on the next page)

OBJECTIVE 2

State the functions of the circulatory system.

1. **Transports various substances to and from body cells, including oxygen, carbon dioxide, food, water, chemicals, hormones, and waste products**
2. **Protects the body against invading organisms**
3. **Helps to regulate body temperature**
4. **Maintains homeostasis**
5. **Transports waste products to excretory organs**

OBJECTIVE 3

List the subsystems of the circulatory system.

✔ **NOTE:** The circulatory system consists of two distinct subsystems. One allows the circulation of **blood** and the other supports the circulation of **lymph**. This module focuses on the blood circulatory system while Module 10 discusses the lymphatic system.

KEY TERMS

Blood (bluhd´)—The liquid pumped by the heart through the arteries, veins, and capillaries, carrying nourishment and oxygen to and bringing away waste products from all parts of the body

✔ **NOTE:** You will study the the terms *arteries, veins,* and *capillaries* in Objective 4.

Lymph (lim{p}f´)—The pale fluid that bathes the tissues, passes into lymphatic vessels and ducts, and is discharged into the blood

1. **Blood circulatory system** (see Figure 1-a on the next page)
2. **Lymphatic system** (see Figure 1-b on the next page)

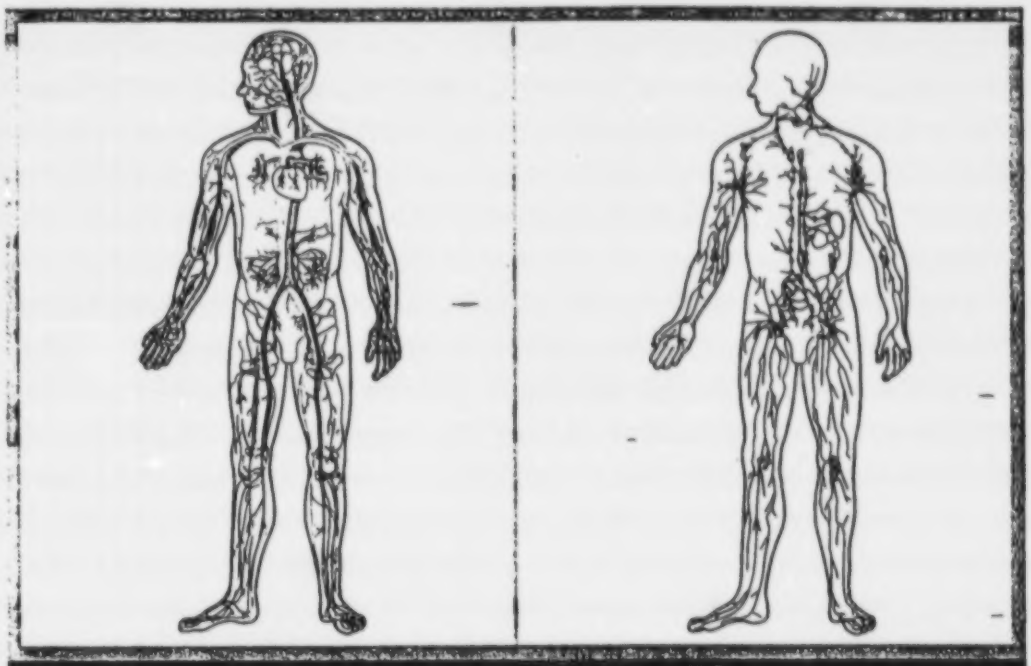


Figure 1-a
Circulatory system—blood

Figure 1-b
Circulatory system—lymphatic

OBJECTIVE 4

Match the major organs of the circulatory system to their correct definitions.

1. **Arteries** (awr´-tuh-res)—The tubular, branching, muscular- and elastic-walled blood vessels that carry blood from the heart through the body

   ✔ **NOTE:** Collectively, arteries, veins, and capillaries are called *blood vessels.*

2. **Heart** (hawrt´)—The hollow, muscular organ that by its rhythmic contraction acts as a force-pump maintaining the circulation of the blood

3. **Veins** (vanz´)—The many blood vessels that convey blood from the capillaries to the heart

4. **Capillaries** (ka´-puh-ler-es)—The smallest blood vessels forming networks throughout the body

5. **Arterioles** (awr-tir´-e-ols)—The small terminal twigs of an artery that end in capillaries

6. **Venules** (ven´-yu{uh}ls)—Small veins and especially the minute veins connecting capillaries with larger veins

7. **Red bone marrow**—A soft, sponge-like material found in the cavities of the diploe, ribs, sternum, vertebral bones, and proximal epiphysis of the humeri and femurs; it consists of a network of blood vessels and special connective tissue that holds together fat and blood-producing cells

8. **Lymphatic vessels**—Fine, transparent, valved channels that carry lymph and tissue fluid, are distributed through most tissues, and are characterized by a beaded appearance

9. **Lymph nodes**—Small, oval structures that filter lymph, fight infection, and form **lymphocytes**, **monocytes**, and **plasma** cells

KEY TERMS

Lymphocyte (lim´-fuh-sit)—One of two types of white blood cells—a T cell or a B cell—that performs various functions related to recognizing, marking, and remembering pathogens based on their antigens

Monocyte (mawn´-uh-sit)—A type of white blood cell that enlarges to form a macrophage in order to perform more-rapid phagocytosis

Plasma (plaz´-muh)—The fluid part of blood and lymph

10. **Spleen** (splen´)—A soft, highly vascular organ located between the stomach and the diaphragm and considered a part of the lymphatic system; it produces **leukocytes**, monocytes, lymphocytes, and plasma cells, stores blood cells, and filters out bacteria and wornout red blood cells

KEY TERM

Leukocyte (lu´-kuh-sit)—Another term for white blood cell

✔ **NOTE:** You will study more about leukocytes in Objective 5.

11. **Thymus** (thi´-muhs)—The glandular structure of largely lymphoid tissue that is located in the upper anterior chest or at the base of the neck and functions especially in the development of the body's immune system

12. **Tonsils** (tawn´-suhlz)—The pair of prominent masses of lymphoid tissue that lie on each side of the throat

OBJECTIVE 5 **Define the major components of blood.**

✔ **NOTE:** Blood is composed of a liquid called *plasma* and a solid portion that consists of three types of blood cells.

1. **Blood plasma**—The liquid part of blood that serves as a source of nutrition and a means of removing waste products from the cells of the body

2. **Erythrocytes** (i-rith´-ruh-sitz)—Red blood cells (RBCs) that transport oxygen and carbon dioxide in support of respiration

3. **Leukocytes** (lu´-kuh-sitz)—White blood cells (WBCs) that ingest and digest foreign particles in blood, form antibodies, and release **heparin**

KEY TERM

Heparin (he´-puh-ruhn)—A chemical that prevents blood from clotting

4. **Thrombocytes** (thrawm´-buh-sitz)—Blood platelets, the tiny protoplasmic discs of the blood that assist in blood **clotting**

KEY TERM

Clotting—The process of blood becoming solid

✔ **NOTE:** Clotting begins when platelets begin to stick to the surfaces of ruptured vessels. The process continues chemically to produce a white, insoluble, fibrous protein called *fibrin* (fi´-bruhn). You will study more about the blood-clotting process in Objective 17.

OBJECTIVE 6 **Complete statements that describe the normal physical characteristics of blood.**

✔ **NOTE:** Blood is an important component of life processes. As such, the chemical and physical characteristics of blood are vitally important. If these characteristics vary too much from normal parameters, then the blood will not be able to perform its functions. For example, if the pH of the blood is too high or low, the cells will not be able to carry adequate amounts of oxygen or sufficient nutrients.

1. **The color of unoxygenated blood in the veins is purple or deep red.**
2. **The color of oxygenated blood in the arteries is bright red.**
3. **Blood tastes slightly metallic and salty.**
4. **Blood is slightly alkaline, with a normal pH of 7.35 to 7.45.**
5. **Blood has a specific gravity of 1.050 to 1.065.**

KEY TERMS

Specific gravity—A comparison of the mass (weight) of a liquid compared to an equal volume of water

✔ **NOTE:** Water represents a specific-gravity value of 1; the specific gravity of blood is slightly greater than that of water.

6. **There are approximately 6 quarts (5000 to 5500 cubic centimeters) of blood in the body of an adult.**

   ✔ **NOTE:** The above amount is equivalent to 5 to 5.5 liters.

7. **The composition of blood is 78 percent water and 22 percent solids or 55 percent plasma and 45 percent cells** (see Figure 2).

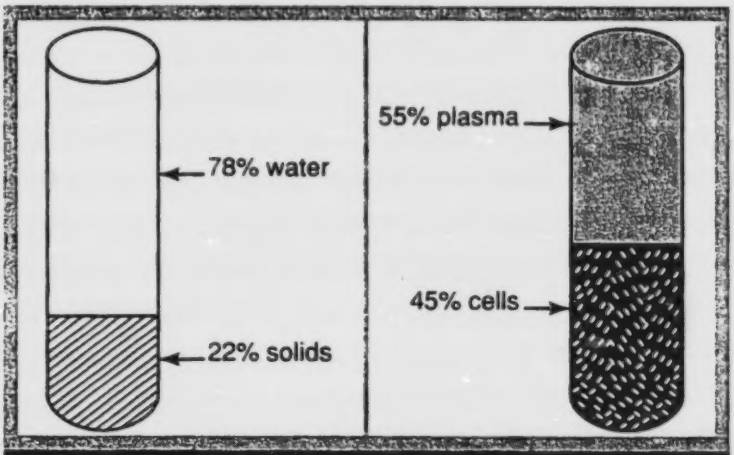


Figure 2
Composition of blood

OBJECTIVE 7 **List the major components of blood plasma.**

1. **Water**

   ✔ **NOTE:** Blood plasma is approximately 90 percent water.

2. **Electrolytes**
3. **The nutrients glucose, amino acids, and fat**
4. **Metabolic wastes, including urea, uric acid, creatinine, and lactic acid**

KEY TERMS

Urea (yu-re´-a)—A nitrogen-rich waste product formed in the liver

Uric (yur´-ik) **acid**—A product of the metabolism of protein that is present in the blood and excreted in the urine

Creatinine (kre-a´-tuhn-en)—A substance that is formed from the metabolism of creatine and is commonly found in blood, urine, and muscle tissue

Creatine (kre´-uh-ten)—An important nitrogenous compound produced by metabolic processes in the body; combined with phosphorus, it forms a high-energy phosphate

Lactic (lak´-tik) **acid**—An organic acid that results from anaerobic cell respiration

5. **Respiratory gases**
6. **Regulatory substances, including hormones and enzymes**
7. **Antibodies**

OBJECTIVE 8 **Complete statements that describe the characteristics of erythrocytes.**

1. **Erythrocytes look like tiny red discs with a thinner central area as compared to the edges and a diameter of approximately 1/3000 of an inch (0.0008 millimeter)** (see Figure 3).

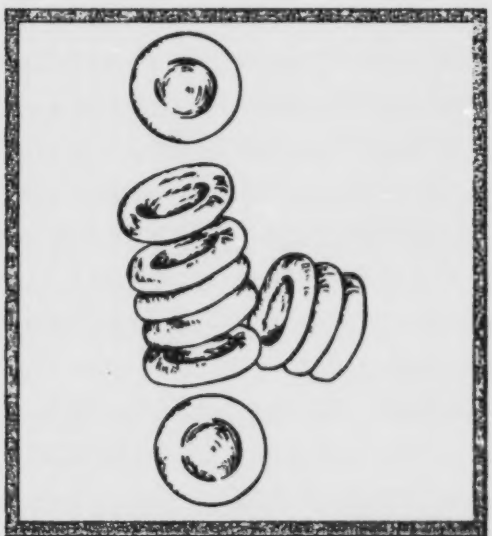


Figure 3
Erythrocytes

2. **Mature erythrocytes do not contain a nucleus and, therefore, do not grow.**
3. **Erythrocytes contain hemoglobin, which is the oxygen-carrying red pigment composed of iron and protein.**
4. **Erythrocytes are formed in red bone marrow at a rate of millions per hour and live for approximately 120 days.**
5. **Immature erythrocytes are called *reticulocytes*** (ri-ti´-kyuh-lo-sitz).
6. **Erythrocytes break apart or rupture in the capillaries of the liver and the spleen, and as broken and ruptured fragments, are broken down by the liver.**
7. **Erythrocytes can be destroyed by mechanical means—bleeding, taking blood from a vein; from hemolysis** (hi-maw´-luh-suhs)**—rupturing of red blood cells—in hypotonic solutions; or from crenation** (kri-na´-shuhn)**—shrinking of red blood cells—in hypertonic solutions.**

OBJECTIVE 9

Complete statements that describe the characteristics of leukocytes.

1. **Leukocytes are colorless, irregularly shaped cells that may or may not contain granules in their cytoplasm.**
2. **Leukocytes live approximately 1 to 12 days.**
3. **There are two types of leukocytes: granulocytes** (gran´-yuh-lo-sitz) **and agranulocytes** (a-gran´-yuh-lo-sitz).
4. **Granulocytes are leukocytes that have granules in their cytoplasm; agranulocytes are leukocytes that do not have granules in their cytoplasm** (see Figure 4 below).
5. **There are three types of granulocytes: neutrophils** (nu´-truh-filz), **eosinophils** (e-uh-si´-nuh-filz), **and basophils** (ba´-suh-filz) (see Figure 4 below).
6. **Neutrophils, eosinophils, and basophils are formed in red bone marrow.**
7. **The primary function of neutrophils is to perform phagocytosis on cellular particles.**
8. **The primary function of eosinophils is to perform phagocytosis on larger organisms.**
9. **The primary function of basophils is to secrete heparin and histamines that are used in the inflammatory response.**
10. **There are two types of agranulocytes: lymphocytes and monocytes** (see Figure 4 below).
11. **Lymphocytes are formed in the lymph nodes.**
12. **Monocytes are formed in the cells that line the capillaries of various organs, especially the spleen.**
13. **The primary function of lymphocytes is to produce antibodies.**
14. **The primary function of monocytes is to perform phagocytosis.**
15. **Of the total amount of leukocytes in the body, 60 to 70 percent are neutrophils, 20 to 30 percent are lymphocytes, and the remaining percentage is composed of trace amounts of the other types of white blood cells.**

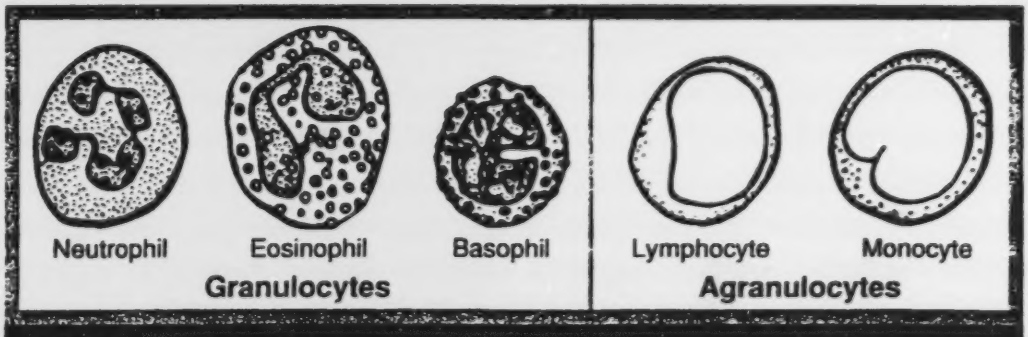


Figure 4
Types of leukocytes

OBJECTIVE 10

Complete statements that describe the characteristics of thrombocytes.

1. **Thrombocytes are round- or oval-shaped cells in the blood** (see Figure 5 below) **that are formed in the red bone marrow and live for 1 to 4 days.**

2. **The primary function of thrombocytes is to initiate blood clotting.**

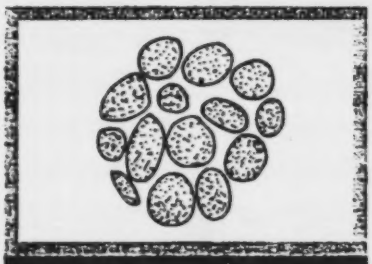


Figure 5
Thrombocytes

OBJECTIVE 11

Define the term *hematology*.

- **Hematology** (he-muh-taw´-luh-je)—The scientific study of blood and blood-forming tissues

OBJECTIVE 12

Define common tests used in hematologic studies.

1. **Complete blood count** (hemogram; CBC)—A screening test that provides diagnostic information concerning the number, type, percentage, concentration, and quality of various blood cells

   ✔ **NOTE:** A CBC usually includes a white-blood-cell count (WBC), red-blood-cell count (RBC), hematocrit (Hct crit, or packed-cell volume [PCV]), hemoglobin (Hb or Hgb), a platelet count, and various other tests. Some of the common tests are defined below.

2. **White-blood-cell count** (WBC)—A test used to determine the total number of white blood cells in a cubic millimeter of blood

3. **Red-blood-cell count** (RBC)—A count of the number of red blood cells per cubic millimeter of blood

4. Hematocrit—A test that determines the percentage of red blood cells in the plasma of a total blood sample

KEY TERM

Hematocrit (hi-ma´-to-krit)—To separate blood

✔ **NOTE:** During this test, the patient's blood sample is spun in a centrifuge and the white blood cells and platelets rise to the top and the red blood cells sink, where they can be counted and calculated as a percentage of the total blood sample.

5. **Hemoglobin**—A test to determine the hemoglobin concentration in red blood cells in order to screen for anemia

   ✔ **NOTE:** You will study anemia in Objective 18.

6. **Platelet count**—A test used to determine the total number of platelets in a cubic millimeter of blood

7. **Reticulocyte count**—A test used to determine the percentage of immature red blood cells of the total of all red blood cells in a blood sample

   ✔ **NOTE:** The percentage of immature red blood cells indicates whether cell production is within normal parameters.

OBJECTIVE 13

State the normal parameters of the common tests used in hematologic studies.

1. **Normal values for a white-blood-cell count for adults**—5000 to 10,000 per cubic millimeter of blood

2. **Normal values for a red-blood-cell count for adults**

   - Adult males—4.6 to 6.2 million per cubic millimeter of blood
   - Adult females—4.2 to 5.4 million per cubic millimeter of blood

   ✔ **NOTE:** During pregnancy, red-blood-cell counts are slightly lower than normal adult-female numbers.

3. **Normal hematocrit values for adults**

   - Adult male—40 to 50 percent
   - Adult female—37 to 47 percent

   ✔ **NOTE:** During pregnancy, the hematocrit value is decreased, especially in the last trimester as plasma volume increases.

4. **Normal hemoglobin values for adults**

   - Adult male—13 to 18 grams per deciliter
   - Adult female—12 to 16 grams per deciliter

5. **Normal values for a platelet count for adults**—200,000 to 500,000 per cubic millimeter

6. **Normal values for a reticulocyte count for adults**

   - Adult males—0.5 to 1.5 percent of all red blood cells
   - Adult females—0.5 to 2.5 percent of all red blood cells

OBJECTIVE 14

Complete statements that describe the characteristics of the Rh blood-group factor.

1. **The Rh factor is an antigen that may or may not be present in the red blood cells of people.**
2. **Persons with the antigen present in their red blood cells are referred to as *Rh positive* and represent about 85 percent of all individuals.**
3. **Persons without the antigen present in their red blood cells are referred to as *Rh negative*.**
4. **A person's Rh factor becomes critical in two instances: blood transfusions and pregnancy.**
5. **During blood transfusions, an Rh negative person must not be given Rh positive blood because the recipient's blood system will produce antibodies that attack the erythrocytes in the donated blood.**
6. **If, during pregnancy, an Rh negative mother is carrying an Rh positive fetus, the mother may become sensitized to the proteins produced by the fetus. In a subsequent pregnancy, the mother's antibodies may pass to the fetus and destroy the fetus' erythrocytes. This condition in the fetus is called *erythroblastosis fetalis*** (i-rith-ruh-blas-to-suhs fi-ta´-luhs). **Erythroblastosis fetalis is generally treated by providing the baby with a complete blood replacement with Rh negative blood immediately after birth.**

OBJECTIVE 15

Complete statements that describe the characteristics of the human blood groups (blood types).

1. **Human blood is divided into four blood groups or types based on the presence or absence of blood antigens called *agglutinogens*** (uh-glu´-tuhn-uh-juhnz) **on the surface of red blood cells.**
2. **The four blood groups are A, B, AB, and O.**
3. **Type A blood has A antigen; type B blood has B antigen; type AB blood has both A and B antigens; and type O blood has neither A nor B antigens.**
4. **A person's blood group must be considered for transfusions.**
5. **Persons with type A blood represent 41 percent of the population, and they can donate blood to persons with type A or type AB blood and receive blood from persons with type A or type O blood.**
6. **Persons with type B blood represent 10 percent of the population, and they can donate blood to people with type B or type AB blood and receive blood from people with type B or type O blood.**
7. **Persons with type AB blood represent 4 percent of the population, and they can donate blood to people with type AB blood and receive blood from people with type A, B, AB, or O blood.**

✔ **NOTE:** Because people with type AB blood can receive blood from people with type A, B, AB, or O blood, type AB blood is called the *universal recipient*.

8. **Persons with type O blood represent 45 percent of the population, and they can donate blood to people with type A, B, AB, or O blood and receive blood from people with type O blood.**

   ✔ **NOTE:** Because people with type O blood can give blood to people with type A, B, AB, or O blood, type O blood is called the *universal donor.*

OBJECTIVE 16 **Describe the factors that must be considered when blood is matched for a transfusion.**

1. **There are four blood groups, each of which can be either Rh negative or Rh positive.**

2. **When blood is matched, both the blood type and the Rh factor must be considered; thus, blood is referred to by both its blood type and its Rh factor, such as O+, AB–, etc.**

OBJECTIVE 17 **Complete statements that describe the blood-clotting process (blood coagulation).**

1. **Blood clotting consists of two aspects—mechanical and chemical.**

2. **The mechanical aspect involves the entrapment of platelets, while the chemical aspect involves proteins that are present in the blood and are released by the liver to form a mechanical trap that catches blood cells.**

3. **The liver releases the plasma proteins prothrombin** (pro-thrawm´-buhn) **and fibrinogen** (fi-bri´-nuh-juhn).

4. **When cells are injured, platelets are snagged in the walls of blood vessels and release a complex substance called *thromboplastin*** (thrawm-bo-plas´-tuhn).

5. **Prothrombin and thromboplastin form the enzyme thrombin** (thrawm´-buhn) **in plasma.**

6. **Thrombin and fibrinogen form an insoluble protein called *fibrin*, which creates a network of fine "threads" that catch red blood cells.**

7. **The thread network and captured cells form a thrombus** (thrawm´-bus)**, which is another term for a blood clot.**

   ✔ **NOTE:** While thrombi are an important factor in preventing excessive blood loss, occasionally they break loose from their point of formation and can create an obstruction elsewhere in the circulatory system.

OBJECTIVE 18 **Match common disorders and abnormalities of the blood to their correct definitions.**

1. **Anemia** (uh-ne´-me-uh)—Any of several blood defects in which there is an inadequate number of red blood cells or an insufficient amount of hemoglobin that is characterized by fatigue, dizziness, headache, insomnia, and pallor

   ✔ **NOTE:** Some of the more-common forms of anemia are discussed in items 2 through 6 on the next page.

2. **Iron-deficiency anemia**—A condition of low hemoglobin as a result of insufficient dietary iron

3. **Pernicious anemia**—A condition in which the red blood cells are large, misshapen, and fragile due to a lack of vitamin B_{12} in the diet or an inability of the body to process vitamin B_{12}, often as a result of an autoimmune destruction of the parietal cells of the stomach lining

KEY TERM

Pernicious (puhr-ni´-shuhs)—Potentially injurious, destructive, or fatal unless treated

4. **Sickle-cell anemia**—A severe, chronic, incurable genetic disorder in which the hemoglobin causes the red blood cells to curl and rupture, leading to clogged capillaries and characterized by joint pain, lethargy, and weakness

   ✔ **NOTE:** This genetic disorder is more prevalent among the Negroid race.

5. **Aplastic anemia**—A condition in which the red bone marrow ceases to produce adequate numbers of red blood cells, usually as a result of exposure to radiation or chemicals

KEY TERM

Aplastic (a-plas´-tik)—Pertaining to the absence or defective development of a tissue or organ

6. **Hemolytic** (he´-muh-li-tik) **anemia**—Any condition, such as Rh disease or malaria, that causes the red blood cells to rupture prematurely before the end of their normal life span

7. **Jaundice** (jon´-duhs)—A yellow discoloration of the skin, mucous membranes, and eyes that is caused by greater-than-normal amounts of **bilirubin** in the blood

   ✔ **NOTE:** Jaundice is a symptom of many disorders, including liver disease and hemolytic anemia.

KEY TERM

Bilirubin (bi-li-ru´-buhn)—The orange-yellow pigment of bile that is formed principally by the breakdown of hemoglobin in red blood cells after termination of their normal lifespan

8. **Rh disease**—A condition in which the Rh factor of the mother's blood and that of her newborn are not compatible

9. **Leukemia** (lu-ke´-me-uh)—A malignancy of the blood-forming tissues that results in excessive production of immature white blood cells

   ✔ **NOTE:** There are two forms of leukemia—acute and chronic. Acute leukemia usually has a sudden onset and rapidly progresses from early signs, such as fatigue, pallor, weight loss, and easy bruising, to fever, hemorrhages, extreme weakness, bone or joint pain, and repeated infections. Chronic leukemia develops slowly, and the signs similar to those of acute forms of the disease may not appear for years.

10. **Thrombosis** (thrawm-bo´-suhs)—An abnormal vascular condition in which thrombus develops within a blood vessel of the body

11. **Embolism** (em´-buh-li-zuhm)—An abnormal circulatory condition in which an **embolus** travels through the bloodstream and becomes lodged in a blood vessel

    ✔ **NOTE:** The symptoms of an embolism vary, depending on the degree of blockage that results, the character of the embolus, and the size, nature, and location of the vessel.

KEY TERM

Embolus (em´-buh-luhs)—A foreign object, a quantity of air or gas, a bit of tissue or tumor, or a piece of thrombus that circulates in the bloodstream until it becomes lodged in a vessel

12. **Hemophilia** (he-muh-fi´-le-uh)—A genetic disorder in which a person's blood fails to clot properly

13. **Thrombocytopenia** (thrawm-buh-si-tuh-pe´-ne-uh)—A clotting disorder that results from abnormally low platelet counts, usually caused by bone-marrow destruction

14. **Leukopenia** (lu-kuh-pe´-ne-uh)—A condition in which the white-blood-cell count is abnormally low, usually caused by an adverse drug reaction, radiation poisoning, or pathologic conditions

15. **Leukocytosis** (lu-kuh-si-to´-suhs)—A condition in which the white-blood-cell count is abnormally high, often as a result of an infection

OBJECTIVE 19

Assignment Sheet 1—Practice Critical Thinking: Complete Case Studies on the Role of Blood in Maintaining Good Health

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Case-study presentation followed agreed-upon format	_____
• Case-study presentation met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

The importance of blood is often overlooked. While we easily recognize the critical role of the brain and heart in maintaining life, blood, partially because it is found throughout the body, seems not to have the same significance. The purpose of this assignment sheet is to focus your attention on blood as a component of the body and to allow you to assess its importance in maintaining health and homeostasis.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Check with your instructor to determine which of the following four case studies you will complete. Write the numbers of those case studies on the blank line on the next page.

_____ 3. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your case studies. Describe that format on the blank lines on the next page.

_____ 4. Check with your instructor to agree upon the criteria he or she will use to evaluate your case-study presentation. Describe those criteria on the blank lines on the next page.

_____ 5. Complete your case-study presentation and return it to your instructor for evaluation.

Case-study numbers _____

Format of case-study presentation _____

_____

_____

_____

_____

_____

Evaluation criteria for case-study presentation _____

_____

_____

_____

_____

_____

Case Study 1

A loss of blood will eventually lead to death. However, death does not occur immediately because the body can continue to function with some loss of blood. One outcome of excessive blood loss is referred to as *hypovolemic* (hi-po-vo-le´-mik) *shock*. Describe the symptoms of hypovolemic shock, its role in protecting the body, and methods for preventing hypovolemic shock by preventing the loss of blood.

Case Study 2

Researchers have long been trying to develop synthetic blood components to help overcome the shortages in blood supplies for medical uses. Consult references available through your facility to determine the latest developments in this research and the status of potential sources of blood other than human donors.

Case Study 3

Health-care facilities must have a reliable source of good blood and procedures to ensure that it is properly stored and administered. Report on your facility's procedures or the procedures of some other facility assigned to you by your instructor in obtaining and verifying quality of blood and the procedures for storing and handling blood to ensure that it is safe and that it is properly matched to patients who receive it. There may be differences in the procedures for whole blood versus plasma or serum. Indicate these differences in your report.

Case Study 4

Some athletes perform a practice known as *blood-doping*. In blood-doping, the athlete has some of his or her blood removed a few weeks before competition. The red blood cells are separated from the rest of the blood and frozen. Just before the important athletic event, the red blood cells are thawed and injected into the athlete. The intent is that by having a larger volume of red blood cells, the blood will be able to carry more oxygen, which in theory should enhance the athlete's performance. If an athlete came to your medical facility and requested blood-doping, how would you respond? Limit your response to the medical considerations of the practice and not to any perceived ethical considerations.

MODULE SET II:
Major Body Systems

Module 8: Circulatory System—Cardiac

1219

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Describe and Evaluate Types of Cardiac Pacemakers	19

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** — Pretest provided by your instructor.
- ❑ 2. **Stop** — Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** — Module Objective Sheet.
- ❑ 4. **Study** — Information Sheet, Objective 1 through Objective 17.
- ❑ 5. **Research** — Online resources to learn more about the circulatory system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** — Written Test provided by your instructor.
- ❑ 7. **Stop** — Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** — Assignment Sheet 1, "Practice Critical Thinking: Describe and Evaluate Types of Cardiac Pacemakers."
- ❑ 9. **Stop** — Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** — With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures and tissues of the heart, describe cardiopulmonary circulation and the conduction system of the heart, and define common disorders and abnormalities of the heart. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *cardiovascular system.*
2. Complete statements that describe the size and position of the heart.
3. List the major structures of the heart.
4. Define the tissue layers of the heart.
5. Complete statements that describe the characteristics of the chambers of the heart.
6. Complete statements that describe the characteristics of the major veins of the heart.
7. Complete statements that describe the characteristics of the major arteries of the heart.
8. Complete statements that describe the characteristics of the major valves of the heart.
9. Label the major structures of the heart.
10. Define the term *cardiopulmonary circulation.*
11. Arrange in order the sequence of blood flow in cardiopulmonary circulation.
12. Complete statements that describe the characteristics of the coronary arteries and veins.
13. Define the term *conduction system of the heart.*
14. Define the major structures of the conduction system of the heart.
15. State the sequence for the conduction of a contraction of the heart in a heartbeat.
16. Define the sounds of a heartbeat.
17. Match common disorders and abnormalities of the heart to their correct definitions.
18. Practice critical thinking: describe and evaluate types of cardiac pacemakers. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *cardiovascular system*.

- **Cardiovascular system**—The network of anatomical structures, including the heart and the blood vessels, that pump blood throughout the body

✔ **NOTE:** In this module, you will study the **cardiac** circulatory system, and in Module 9, you will study the **vascular** system, which are the subsystems of the cardiovascular system.

KEY TERMS

Cardiac– Of or pertaining to the heart

Vascular– Of or pertaining to the blood vessels

OBJECTIVE 2

Complete statements that describe the size and position of the heart.

1. **The heart is a hollow, muscular organ that is about the size and shape of a person's fist and weighs 9 to 13 ounces (250 to 350 grams).**

2. **The heart is suspended in the thoracic cavity by vessels and lies in the mediastinum with approximately two-thirds of its mass to the left of the midline of the body.**

KEY TERM

Mediastinum (me-de-uh-sti´-nuhm)—A portion of the thoracic cavity in the middle of the thorax, between the pleural sacs containing the two lungs

3. **The heart rests obliquely in the body with the right side anterior to the left side; it rests on the diaphragm with the apex pointing left and is positioned with the base below the second rib.**

KEY TERMS

Apex (a´-peks)—The lower border of the heart (see Figure 1 on page 11)

Base—The upper border of the heart

4. **The heart lies in a fibrous, loose-fitting sac called the *pericardium*** (per-uh-kawr´-de-uhm) (see Figure 1 on page 11), **which consists of the serous pericardium and the fibrous pericardium.**

5. **The serous pericardium consists of a parietal layer, which lines the inside of the fibrous pericardium, and a visceral layer, which adheres to the surface of the heart.**

6. **Between the two layers of the pericardium is the pericardial space, which contains the pericardial fluid that lubricates the opposing surfaces of the space and allows the heart to move easily during contraction.**

OBJECTIVE 3 **List the major structures of the heart.**

1. **Septum** (sep´-tuhm)

   ✔ **NOTE:** The septum is the partition or wall that divides the heart into right and left halves (see Figure 1 on page 11). The right half of the heart contains venous blood and the left half contains arterial blood.

2. **Chambers**

   ✔ **NOTE:** A chamber is a hollow but not necessarily empty space or cavity in an organ. The heart is divided into four chambers, which you will study in Objective 5.

3. **Veins**

   ✔ **NOTE:** As you studied in Module 7, veins convey blood to the heart. You will study the major veins of the heart in Objective 6.

4. **Arteries**

   ✔ **NOTE:** Arteries carry blood from the heart, you will study the major arteries of the heart in Objective 7.

5. **Valves**

   ✔ **NOTE:** A valve is a structure in a vessel that prevents the backflow of blood. There are four major valves in the heart, which you will study in Objective 8.

OBJECTIVE 4 **Define the tissue layers of the heart.**

✔ **NOTE:** The heart consists of three layers of tissue (see Figure 1 on page 11).

1. **Endocardium** (en-do-kawr´-de-uhm)—The innermost serous membrane that lines the chambers of the heart and its valves

2. **Myocardium** (mi-uh-kawr´-de-uhm)—The middle layer of heart tissue that consists of cardiac muscle that contracts to provide the pumping action of the heart

3. **Epicardium**—The outer serous membrane of the heart

   ✔ **NOTE:** The epicardium is the visceral portion of the serous pericardium and folds back upon itself to form the parietal portion of the serous pericardium.

OBJECTIVE 5 **Complete statements that describe the characteristics of the chambers of the heart.**

1. **The heart is divided into four chambers: (1) the right atrium** (a´-tre-uhm), **(2) the right ventricle** (ven´-tri-kuhl), **(3) the left atrium, and (4) the left ventricle** (see Figure 1 on page 11).

2. **The two upper chambers—the atria—collect blood; the right atrium receives deoxygenated blood and the left atrium receives oxygenated blood.**

3. **The two lower chambers—the ventricles—pump blood from the heart; the right ventricle pumps deoxygenated blood to the lungs and the left ventricle pumps oxygenated blood to the body.**

   ✔ **NOTE:** The right side of the heart provides for the oxygenation of blood (pulmonary circulation), and the left side of the heart is responsible for transportation of blood to the body (systemic circulation).

4. **Because they do the pumping, the ventricles consist of thicker muscle tissue than the atria, and the left ventricle, which pumps blood to the body, is approximately three times thicker than the right ventricle.**

OBJECTIVE 6 **Complete statements that describe the characteristics of the major veins of the heart.**

1. **Deoxygenated blood returns to the heart from the body by the way of two large veins—the superior vena cava and the inferior vena cava** (see Figure 1 on page 11).

2. **The superior vena cava carries blood from the upper part of the body.**

3. **The inferior vena cava carries blood from the lower part of the body.**

4. **The superior and inferior venae cavae deposit deoxygenated blood into the right atrium** (see Figure 1 on page 11).

5. **The right and left pulmonary veins carry oxygenated blood back to the heart from the lungs.**

6. **The pulmonary veins deposit oxygenated blood in the left atrium** (see Figure 1 on page 11).

OBJECTIVE 7

Complete statements that describe the characteristics of the major arteries of the heart.

1. **When the heart contracts, blood leaves the right ventricle of the heart through the left pulmonary artery and the right pulmonary artery and travels to the lungs** (see Figure 1 on the next page).
2. **When the heart contracts, oxygenated blood leaves the left ventricle through the aorta** (see Figure 1 on the next page), **the largest artery of the body.**
3. **The aorta branches into smaller arteries that carry blood to all the parts of the body.**

OBJECTIVE 8

Complete statements that describe the characteristics of the major valves of the heart (see Figure 1 on the next page).

1. **There are four major valves in the heart: (1) the tricuspid valve, (2) the bicuspid valve, (3) the pulmonary valve, and (4) the aortic valve.**
2. **The tricuspid valve is located between the right atrium and the right ventricle and consists of three main cusps (flaps).**
3. **The bicuspid valve, which is also called the *mitral*** (mi´-truhl) ***valve*, is located between the left atrium and the left ventricle and consists of two cusps.**
4. **The pulmonary valve, which is also called the *pulmonary semilunar valve*, is located in the pulmonary artery and consists of three semilunar cusps that prevent blood from flowing back into the right ventricle from the pulmonary artery.**

KEY TERM

Semilunar (se-me-lu´-nuhr)—Half-moon shaped

5. **The aortic valve, which is also called the *aortic semilunar valve*, is located between the left ventricle and the aorta and consists of three semilunar cusps that prevent blood from flowing back into the left ventricle from the aorta.**

OBJECTIVE 9

Label the major structures of the heart (see Figure 1).

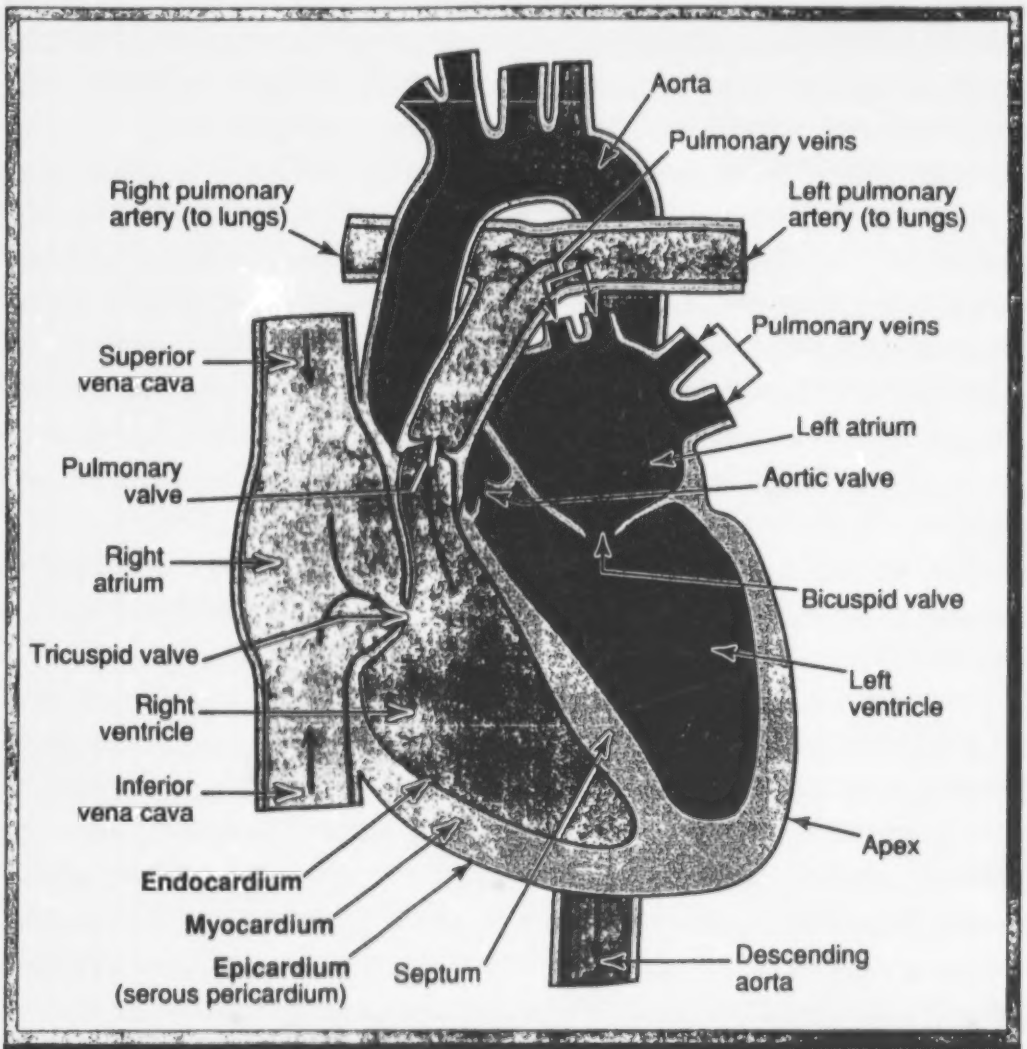


Figure 1
Major structures of the heart

OBJECTIVE 10

Define the term *cardiopulmonary circulation*.

- **Cardiopulmonary circulation**—The circulation of blood from the right ventricle of the heart to the lungs and back to the left atrium of the heart

OBJECTIVE 11

Arrange in order the sequence of blood flow in cardiopulmonary circulation (see Figure 2).

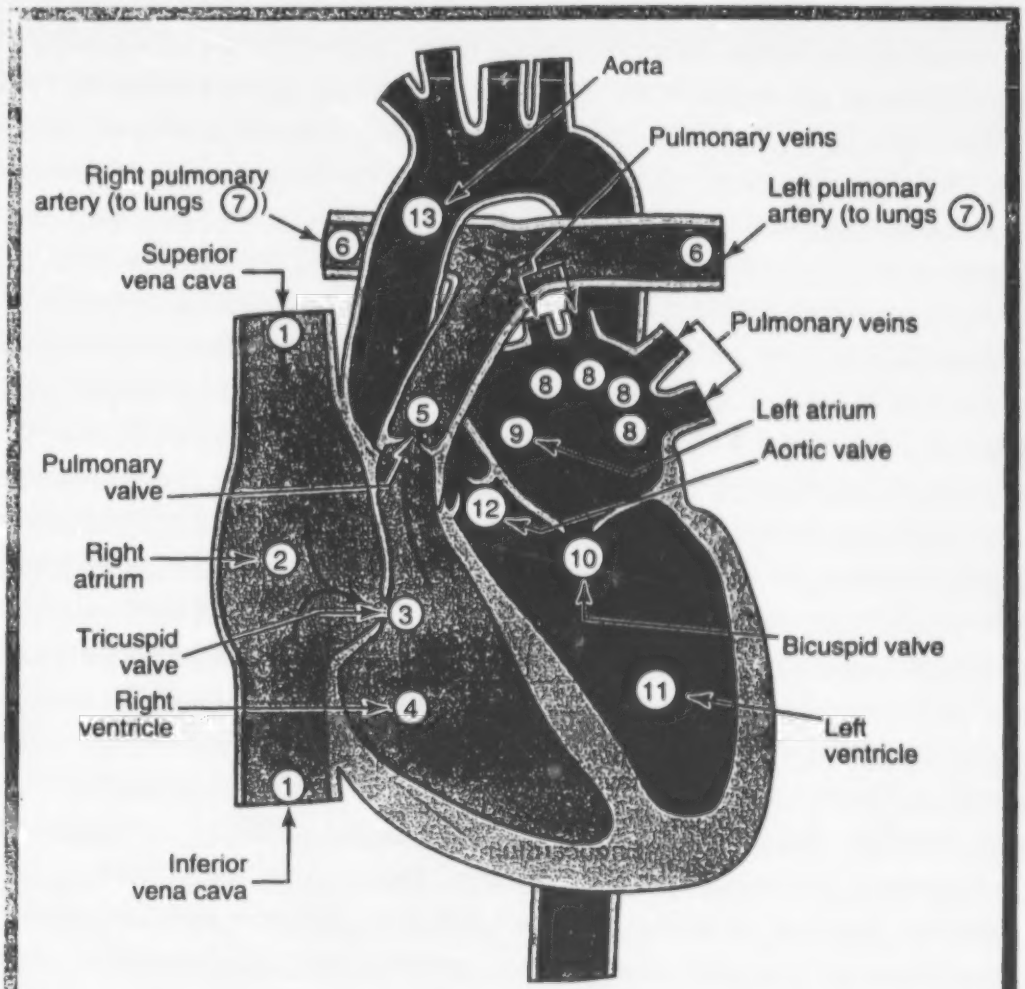


Figure 2
Sequence of blood flow in cardiopulmonary circulation

OBJECTIVE 12

Complete statements that describe the characteristics of the coronary arteries and veins.

1. **Blood passing through the chambers of the heart cannot be used by the myocardium.**

2. **A coronary system, consisting of coronary arteries and coronary veins, provides the circulatory system for the heart.**

3. **Two coronary arteries branch from the aorta and supply the heart** (see Figure 3); **the right coronary artery supplies the right side of the heart and the left coronary artery supplies the left side of the heart.**

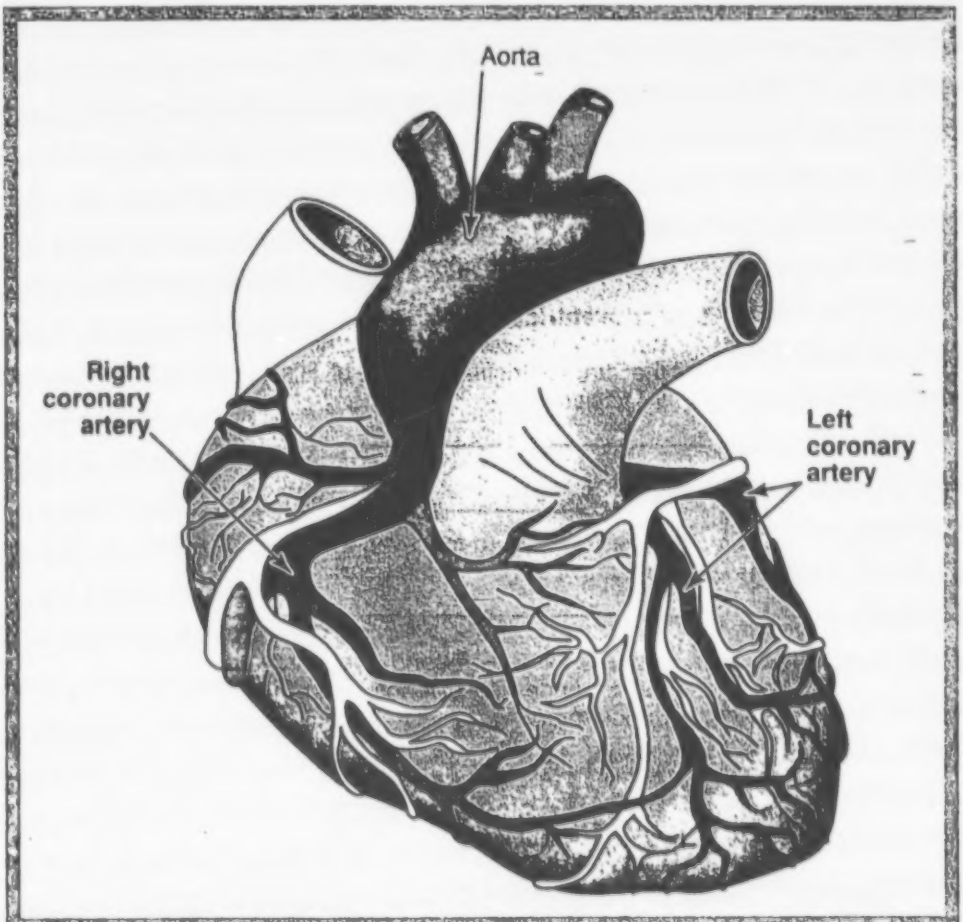


Figure 3
Coronary arteries

4. **The coronary veins drain blood from the capillary beds of the myocardium and into the right atrium of the heart.**

OBJECTIVE 13

Define the term *conduction system of the heart.*

■ **Conduction system of the heart**—The network of nervous tissue that transmits the electrical impulses needed for a **heartbeat**

✔ **NOTE:** The major structures of the conduction system of the heart consist of four masses of specialized cells you will study in the next objective.

KEY TERM

Heartbeat (hawrt´-bet)—One complete pulsation of the heart

OBJECTIVE 14

Define the major structures of the conduction system of the heart (see Figure 4 on the next page).

1. **Sinoatrial** (SA) (si-no-a´-tre-uhl) **node**—The cluster of cells located in the right atrium near the opening of the superior vena cava and consisting of a knot of modified heart muscle that generates electrical impulses throughout the muscle fibers of both atria, causing them to contract

2. **Atrioventricular** (AV) **node**—The cluster of cells located at the base of the right atrium that receives the electrical impulse from the sinoatrial node and conducts it to the atrioventricular bundle of His (see item 3 below) and then to the walls of the ventricles

KEY TERM

Atrioventricular (a-tre-o-ven-tri´-kyuh-luhr)—Of, relating to, or located between an atrium and ventricle of the heart

3. **Bundle of His**—A band of cardiac muscle fiber that arises from the distal portion of the AV node and extends across the septum, where it divides into the left and right bundle branches

✔ **NOTE:** The bundle of His is also called the *atrioventricular bundle* or *His bundle.*

4. **Purkinje** (puhr-kin´-je) **fibers**—The myocardial fibers that are a continuation of the bundle branches and extend into the muscle walls of the ventricles

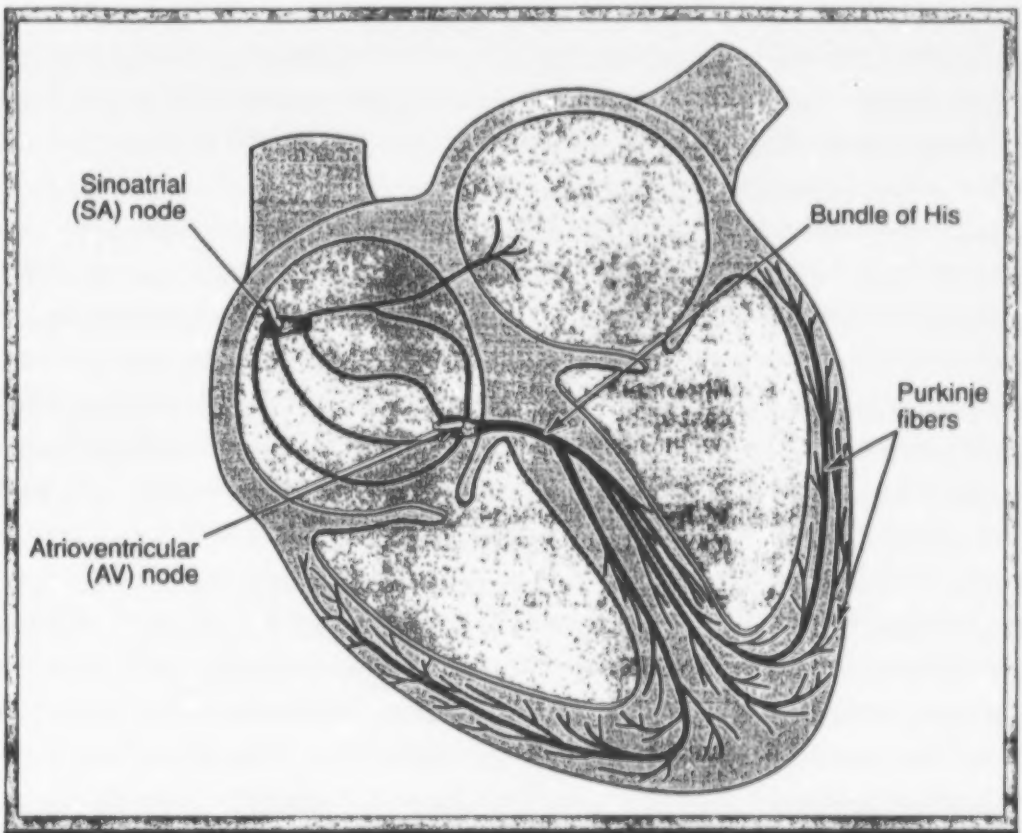


Figure 4
Major structures of the conduction system of the heart

OBJECTIVE 15

State the sequence for the conduction of a contraction of the heart in a heartbeat.

1. **Each electrical impulse discharged by the SA node is transmitted to the AV node, causing the atria to contract.**
2. **From the AV node, the electrical impulses are conducted to the bundle of His and its right and left branches.**
3. **From the branches of the bundle of His, the electrical impulses are conducted to the Purkinje fibers, which extend into the walls of the ventricles, causing them to contract.**

OBJECTIVE 16

Define the sounds of a heartbeat.

1. **Lub**—The longer, louder portion of a heartbeat that is produced by the closing of the atrioventricular valves (tricuspid valve and bicuspid valve) during contraction
2. **Dub**—The shorter, softer portion of a heartbeat that is produced by the closing of the semilunar valves (pulmonary valve and aortic valve)

OBJECTIVE 17

Match common disorders and abnormalities of the heart to their correct definitions.

1. **Atherosclerosis** (a-thuh-ro-skluh-ro´-suhs)—A common arterial disorder characterized by yellowish **plaque** and other materials along the walls of large- and medium-sized arteries, causing the vessels to narrow and reducing blood flow to the organs normally supplied by the arteries

KEY TERM

Plaque (plak´)—A localized abnormal patch on a body part or surface

2. **Rheumatic** (ru-ma´-tik) **heart disease**—Damage to heart muscle and heart valves caused by rheumatic fever, a streptococcal infection, which may result in permanent deformities of the heart

   ✔ **NOTE:** Damage to the heart may be evident during acute rheumatic fever, or it may not be discovered until long after the acute disease has subsided.

3. **Stenosis** (stuh-no´-suhs)—A narrowing of the heart valves

   ✔ **NOTE:** Aortic stenosis obstructs the flow of blood from the left ventricle into the aorta, causing decreased cardiac output and pulmonary vascular congestion.

4. **Bradycardia** (bra-di-kawr´-de-uh)—An abnormally slow heart rate generally defined as less than 60 beats per minute at rest

   ✔ **NOTE:** If left untreated, an abnormally slow heartbeat causes decreased cardiac output, leading to faintness, dizziness, chest pain, and eventually circulatory collapse.

5. **Tachycardia** (ta-ki-kawr´-de-uh)—An abnormally fast heart rate generally defined as more than 100 beats per minute at rest

   ✔ **NOTE:** An abnormally fast heart rate increases the amount of oxygen delivered to the cells of the body by increasing the amount of blood circulated through the vessels. Tachycardia may lead to congestive heart failure, hemorrhage, or shock.

6. **Arrhythmia** (a-rith´-me-uh)—Any irregular rhythm of the heart

7. **Palpitation** (pal-puh-ta´-shuhn)—A pounding or racing of the heart that is associated with normal emotional responses or with heart disorders

   ✔ **NOTE:** Palpitations may or may not be a sign of heart disease. Some people may complain of pounding hearts but have no heart disease. Other people with serious heart disease may not detect palpitations.

8. **Ventricular fibrillation** (ven-tri´-kyuh-luhr fi-bruh-la´-shuhn)—A failure of ventricle pumping action characterized by a complete lack of organized electric impulse, conduction, and ventricular contraction

   ✔ **NOTE:** Ventricular fibrillation causes blood pressure to fall to zero, resulting in unconsciousness and death if untreated.

9. **Flutter** (fluh´-tuhr)—A very rapid, regular heartbeat that may interfere with normal function

10. **Mitral-valve prolapse** (mi´-truhl valv´ pro-laps´) (MVP)—A condition characterized by leakage in the bicuspid valve due to its abnormal extension into the left atrium

    ✔ **NOTE:** Most patients with MVP have no symptoms, but some may experience chest pain, palpitations, and fatigue. The condition may result in the enlargement of the left atrium and ventricle.

11. **Coronary-artery disease** (kor´-uh-ner-e awr´-tuh-re di-zez´)—Any one of the abnormal conditions that may affect the arteries of the heart and produce various pathologic effects, especially the reduced flow of oxygen and nutrients to the myocardium

    Example: Coronary atherosclerosis

12. **Myocardial infarction** (mi-uh-kawr´-de-uhl in-fawrk´-shuhn) (MI)—The death of heart-muscle tissue that is often due to an obstruction of the coronary artery

    ✔ **NOTE:** Myocardial infarction—often called a *heart attack*—is characterized by a crushing, viselike chest pain that may radiate to the left arm or neck and sometimes stimulates the sensation of acute indigestion or gallbladder attack.

13. **Angina pectoris** (an-ji´-nuh pek´-tor-is)—Severe chest pain caused by oxygen deprivation to the myocardium as a result of atherosclerosis of the coronary arteries

    ✔ **NOTE:** The pain associated with an angina-pectoris attack usually radiates down the inner part of the left arm and is frequently accompanied by a feeling of suffocation and impending death. Attacks are often related to exertion, emotional stress, and exposure to intense cold.

14. **Congestive heart failure** (CHF)—An inability of the left ventricle to pump adequately, resulting in failure of the ventricle to eject blood efficiently, causing volume overload, chamber dilatation, and elevated intracardiac pressure

15. **Pulmonary edema** (pul´-muh-ner-e i-de´-muh)—Congested pulmonary circulation caused most commonly by congestive heart failure

    ✔ **NOTE:** A person with pulmonary edema breathes rapidly and shallowly with difficulty and is usually restless, apprehensive, hoarse, and pale.

OBJECTIVE 18

Assignment Sheet 1—Practice Critical Thinking: Describe and Evaluate Types of Cardiac Pacemakers

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
◦ Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

The heart beats continuously, but the rate of those beats is not constant. Sometimes the heart beats faster than at other times. This is because the needs of the body change with changes in a person's activities and environment. The rate of heartbeats is governed by a system called the *pacemaker*. There are three types of pacemakers: the heart's normal natural pacemaker, an abnormal natural pacemaker, and artificial pacemakers. In this assignment sheet, you will describe the action of each type of pacemaker, to include an evaluation of the advantages or disadvantages of each.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Read the investigation points on the next page. Your investigative report must include answers to all three of these investigation points.

_____ 3. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided on the next page.

_____ 4. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 5. Complete your investigation and give your investigative report to your instructor for evaluation.

Format of investigative report _____

_____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

_____

INVESTIGATION POINT 1

The sinoatrial node in the heart is the heart's natural pacemaker. Describe how the sinoatrial node functions as a pacemaker, and list the advantages and disadvantages of this type of pacemaker.

INVESTIGATION POINT 2

Ectopic pacemakers are cells in the heart tissue, such as the atrioventricular node or the Purkinje fibers. Describe how the ectopic pacemakers function, and list the advantages and disadvantages of these pacemakers.

INVESTIGATION POINT 3

Artificial pacemakers are electronic devices implanted in the body. Describe how artificial pacemakers function, and list the advantages and disadvantages of these pacemakers.

MODULE SET II:
Major Body Systems

Module 9: Circulatory System—Vascular

1237

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Determine Cause-and-Effect Relationships Related to the Circulatory System	29

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** — Pretest provided by your instructor.
- ❑ 2. **Stop** — Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** — Module Objective Sheet.
- ❑ 4. **Study** — Information Sheet, Objective 1 through Objective 26.
- ❑ 5. **Research** — Online resources to learn more about the circulatory system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** — Written Test provided by your instructor.
- ❑ 7. **Stop** — Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** — Assignment Sheet 1, "Practice Critical Thinking: Determine Cause-and-Effect Relationships Related to the Circulatory System."
- ❑ 9. **Stop** — Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** — With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the vascular system, state the areas of the body supplied by the major arteries and drained by the major veins, and define common disorders and abnormalities of the vascular system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *vascular system.*
2. List the major structures of the vascular system.
3. Define the term *systemic circulation system.*
4. State the sequence of blood circulation through the major structures of the systemic circulation system.
5. Define the tissue layers of an artery.
6. Label the tissue layers of an artery.
7. Complete statements that describe the characteristics of arteries.
8. Complete statements that describe the characteristics of the aorta in the systemic arterial circulation system.
9. Define the major arteries that extend from the aorta.
10. Label the major arteries of the systemic circulation system.
11. Complete statements that describe the characteristics of capillaries.
12. Define the tissue layers of a vein.
13. Label the tissue layers of a vein.
14. Complete statements that describe the characteristics of veins.
15. Define the major veins of the systemic circulation system.
16. Label the major veins of the systemic circulation system.
17. Define the term *portal circulation system.*
18. Complete statements that describe the characteristics of the portal circulation system.
19. Define the term *pulse point.*

20. State the normal pulse rate of a healthy adult at rest.
21. Label the common pulse points.
22. Define the term *blood pressure*.
23. Complete statements that describe how blood pressure is measured.
24. Describe the factors that affect blood pressure.
25. Complete statements that describe the characteristics of the fetal circulation system.
26. Define common disorders and abnormalities of the vascular system.
27. Practice critical thinking: determine cause-and-effect relationships related to the circulatory system. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *vascular system.*

- **Vascular system**—The portion of the cardiovascular system that deals with the blood vessels that allow for the circulation of blood throughout the body

✔ **NOTE:** As you learned in Module 7, the term *blood vessels* is used when referring collectively to arteries, veins, and capillaries.

OBJECTIVE 2

List the major structures of the vascular system.

1. **Arteries**

✔ **NOTE:** In Module 7, you learned the definitions for the major structures in the vascular system. These definitions are repeated here in this and the following notes. Arteries are the tubular, branching, muscular- and elastic-walled blood vessels that carry blood from the heart through the body.

2. **Arterioles**

✔ **NOTE:** An arteriole is any of the small terminal twigs of an artery that ends in capillaries.

3. **Capillaries**

✔ **NOTE:** A capillary is any of the smallest blood vessels forming networks throughout the body.

4. **Venules**

✔ **NOTE:** A venule is a small vein and, especially, any of the minute veins connecting the capillaries with the larger veins.

5. **Veins**

✔ **NOTE:** A vein is any of the many blood vessels that convey blood from the capillaries to the heart.

OBJECTIVE 3

Define the term *systemic circulation system.*

- **Systemic circulation system**—The circulation system that supplies those parts of the body that receive blood through the aorta rather than through the pulmonary artery

OBJECTIVE 4

State the sequence of blood circulation through the major structures of the systemic circulation system (see Figure 1).

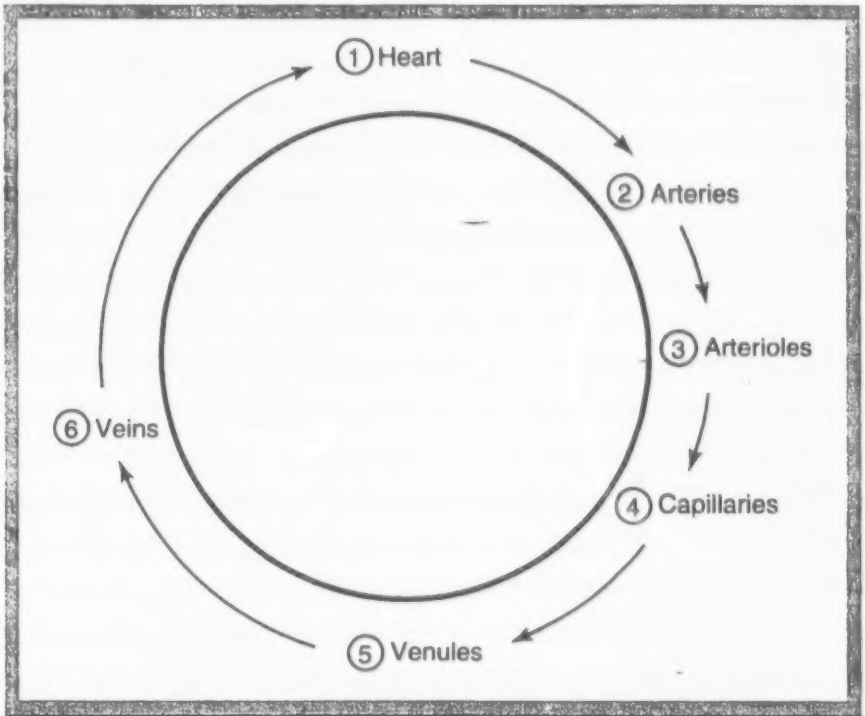


Figure 1
Sequence of blood circulation through the systemic circulation system

OBJECTIVE 5

Define the tissue layers of an artery (see Figure 2 on the next page).

✔ **NOTE:** Many organs—including arteries and veins—display the same composition of tissue layers with endothelium as the inner tissue layer covered by layers of muscle and elastic tissue (see Objective 12).

1. **Tunica intima** (in-ti´-ma)—The innermost tissue layer of an artery that is composed of endothelium

KEY TERM

Tunica (tu´-ni-kuh)—An enveloping membrane or layer of body tissue

2. **Tunica media** (me-di´-uh)—The middle tissue layer of an artery that is composed of involuntary muscle tissue and elastic connective tissue that permits constriction and dilation of the artery

3. **Tunica adventitia** (ad-vuhn-ti´-shuh)—The outermost tissue layer of an artery that is composed of fibrous connective tissue

OBJECTIVE 6

Label the tissue layers of an artery (see Figure 2).

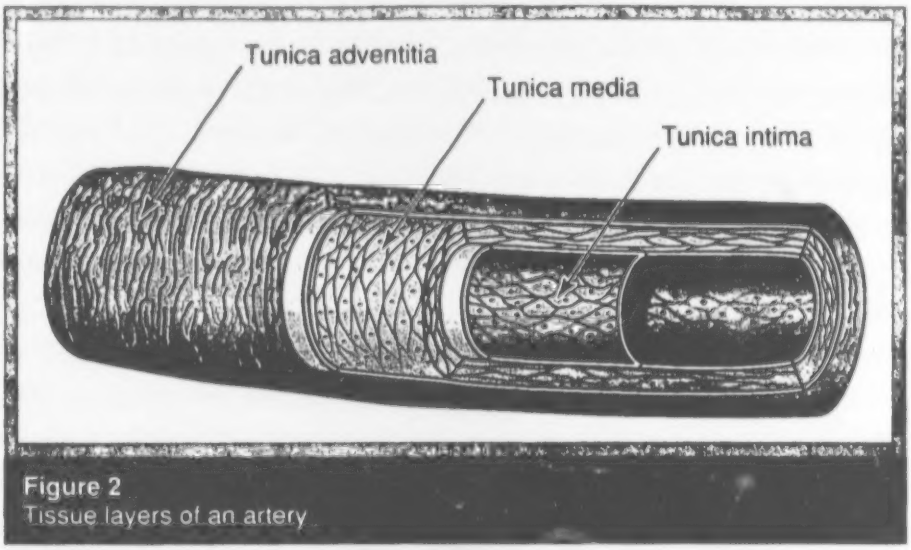


Figure 2
Tissue layers of an artery

OBJECTIVE 7

Complete statements that describe the characteristics of arteries.

1. **Beginning with the aorta, most arteries carry oxygenated blood away from the heart; the pulmonary artery is an exception, as it carries deoxygenated blood from the heart to the lungs.**

2. **Arteries branch into arterioles and arterioles branch into capillaries.**

3. **The walls of arteries are supplied with oxygen and nutrients by a network of small blood vessels called the *vasa vasorum*** (va´-suh va-sor´-uhm).

4. **The tunica intima (the innermost tissue layer of an artery) causes an artery to stand open when cut.**

5. **Many arteries are referred to by different names as they pass through different areas of the body.**

   Example: The main artery of the leg is called the *femoral* (fe´-muh-ruhl) *artery* as it passes through the thigh, but it is called the *popliteal* (paw-pluh-te´-uhl) *artery* as it passes through the knee and the *posterior tibial* (ti´-be-uhl) *artery* as it passes through the lower leg (see Figure 4 on page 16).

OBJECTIVE 8

Complete statements that describe the characteristics of the aorta in the systemic arterial circulation system.

1. **The aorta is the main trunk of the systemic arterial circulation system.**

2. **The aorta consists of three major branches: (1) the ascending aorta, (2) the aortic arch, and (3) the descending aorta.**

3. **The ascending aorta is the portion of the aorta that begins at the left ventricle and rises upward, branching into the left and right coronary arteries** (see Figure 4 on page 16).

4. **The aortic arch, which is also called the *arch of the aorta*, is the portion of the aorta that turns backward** (see Figure 4 on page 16) **and to the left at the level of the fourth thoracic vertebra.**

5. **The main branches of the aortic arch are different on the right and left side of the body.**

6. **On the right side, the aortic arch branches into a short artery called the *innominate artery*, which then branches into the right carotid artery and the right subclavian artery** (see Figure 4 on page 16).

✔ **NOTE:** The innominate artery is sometimes called the *brachiocephalic* (bra-ke-o-suh-fa´-lik) *artery*.

KEY TERMS

Innominate (i-naw´-muh-muht)—Having no name, unnamed

Carotid (kuh-raw´-tuhd)—Of or relating to or being the chief artery or pair of arteries that pass up the neck and supply the head

Subclavian (suhb-kla´-ve-uhn)—Of or relating to or being a part (an artery, vein, or nerve) located under the clavicle

7. **On the left side, the aortic arch branches directly into the left carotid artery and the left subclavian artery** (see Figure 4 on page 16).

8. **The descending aorta forms two branches as it passes through the body: (1) the thoracic aorta as it passes through the thoracic cavity and (2) the abdominal aorta as it passes through the abdominal cavity** (see Figure 4 on page 16).

9. **The thoracic aorta and the abdominal aorta each branch into many branches** (see Figure 4 on page 16).

10. **The descending aorta ends near the fourth lumbar vertebra at the aortic bifurcation, forming the right common iliac artery and the left common iliac artery** (see Figure 4 on page 16).

KEY TERMS

Bifurcation (bi-fuhr-ka´-shuhn)—The point at which something divides into two branches or parts

Iliac (i´-le-ak)—Of or relating to, or located near the ilium, the last division of the small intestine

OBJECTIVE 9

Define the major arteries that extend from the aorta.

1. **Arteries from the aortic arch** (see Figure 4 on page 16 and the chart in Figure 3 on page 15)

   - **Right subclavian artery**—The main artery from the aortic arch that supplies the right arm and the surrounding area
   - **Left subclavian artery**—The main artery from the aortic arch that supplies the left arm and the surrounding area
   - **Right carotid artery** (right common carotid artery)—The main artery from the aortic arch that supplies the right side of the head, neck, and brain
   - **Left carotid artery** (left common carotid artery)—The main artery from the aortic arch that supplies the left side of the head, neck, and brain
   - **Axillary artery**—One of a pair of the continuations of the subclavian arteries that supplies various chest muscles and arm muscles
   - **Brachial artery**—The principal artery of the upperarm that is the continuation of the axillary artery
   - **Radial artery**—An artery of the forearm starting at the bifurcation of the brachial artery and passing in 12 branches supplying the forearm, wrist, and hand
   - **Ulnar artery**—A large artery branching from the brachial artery and supplying muscles in the forearm, wrist, and hand; it has nine branches: four in the forearm, two in the wrist, and three in the hand

KEY TERMS

Axillary (ak´-suh-ler-e)—Pertaining to the armpit

Brachial (bra´-ke-uhl)—Pertaining to the arm

Radial (ra´-de-uhl)—Pertaining to the radius, the bone of the forearm

Ulnar (uhl´-nuhr)—Pertaining to the ulna, the bone on the little-finger side of the forearm

2. **Arteries from the thoracic aorta** (see the chart in Figure 3 on page 15)

   - **Bronchial arteries**—The arteries from the thoracic aorta that supply the bronchi of the lungs

KEY TERM

Bronchial (brawn´-ke-uhl)—Of or relating to the bronchi of the lungs

- **Esophageal arteries**—The arteries from the thoracic aorta that supply the esophagus
- **Pericardial arteries**—The arteries from the thoracic aorta that supply the pericardium
- **Intercostal arteries**—The nine or ten pairs of arteries from the thoracic aorta that supply the intercostal areas
- **Mediastinal branches**—The artery branches that supply the lymph glands and the posterior mediastinum
- **Superior/phrenic arteries**—The arteries from the thoracic aorta that supply the diaphragm

KEY TERMS

Esophageal (i-saw-fuh-je´-uhl)—Of or relating to the esophagus, the muscular tube that passes from the pharynx to the stomach

Pericardial (per-uh-kawr´-de-uhl)—Of or relating to the pericardium, the sac of serous membrane that encloses the heart

Intercostal (in-tuhr-kaws´-tuhl)—Situated or extending between the ribs

Mediastinal (me-de-uh-sti´-nuhl)—Of or relating to the mediastinum, the space in the chest between the pleural sacs of the lungs that contains all of the viscera of the chest except the lungs

Phrenic (fre´-nik)—Of or relating to the diaphragm

3. **Arteries from the abdominal aorta** (see the chart in Figure 3 on page 15)
   - **Celiac artery**—The artery from the abdominal aorta that supplies the stomach, liver, and spleen
   - **Hepatic artery**—The branch of the celiac artery that supplies the liver
   - **Splenic artery**—The branch of the celiac artery that supplies the spleen (see Figure 4 on page 16)

KEY TERMS

Celiac (se´-le-ak)—Of or relating to the abdominal cavity

Hepatic (hi-pa´-tik)—Of or relating to the liver

Splenic (sple´-nik)—Relating to the spleen

- **Left gastric artery**—The branch of the celiac artery that supplies the stomach
- **Superior mesenteric artery**—The artery from the abdominal artery that supplies all of the small intestine except the superior portion of the duodenum
- **Inferior mesenteric artery**—The artery from the abdominal artery that supplies all of the colon and rectum except the right half of the transverse colon
- **Middle suprarenal branches**—The branches of the abdominal artery that supply the adrenal (suprarenal) glands
- **Renal artery**—One of a pair of large branches of the abdominal aorta that supplies the kidneys, suprarenal glands, and the ureter (see Figure 4 on page 16)
- **Testicular arteries**—The pair of long, slender branches of the abdominal aorta that supplies the testes and ureter in a male
- **Ovarian arteries**—The pair of slender branches of the abdominal aorta that supplies the ovaries, part of the ureters, and uterine tubes in a female
- **Inferior phrenic arteries**—The arteries from the abdominal aorta that supply the diaphragm and esophagus
- **Lumbar arteries**—The arteries from the abdominal aorta that supply the psoas muscles and part of the muscles of the abdominal wall

KEY TERMS

Gastric (gas´-trik)—Of or pertaining to the stomach

Mesenteric (me-zuhn-ter´-ik)—Pertaining to the mesentery, the double layer of peritoneum connecting the intestine to the abdominal wall

Renal (re´-nuhl)—Relating to the kidney

Testicular (tes-ti´-kyuh-ler)—Pertaining to the testes, the male gonads

Ovarian (o-var´-e-uhn)—Of or relating to the ovaries, the female reproductive organs that produce eggs

Lumbar (luhm´-buhr)—Of or pertaining to the part of the body between the thorax and the pelvis

Psoas (so´-uhs) **muscles**—The psoas major and psoas minor muscles in the area of the lumbar vertebrae and pelvis

- **Middle sacral artery**—The artery from the abdominal aorta that supplies the sacrum and the coccyx

KEY TERMS

Sacral (sa´-kruhl)—Of or pertaining to the sacrum, the large triangular bone at the dorsal part of the pelvis

Coccyx (kawk´-siks)—The beaklike bone joined to the sacrum

4. **Arteries from the descending aorta** (see the chart in Figure 3 on the next page)

   - **Right and left common iliac arteries**—The major arteries that branch from the bifurcation of the descending aorta and supply the areas of the body near the ilium (see Figure 4 on page 16)
   - **Internal iliac arteries**—The arteries that branch from the common iliac arteries to supply the pelvic organs
   - **External iliac arteries**—The arteries that branch from the common iliac arteries to supply the lower extremities
   - **Femoral artery**—The extension of the external iliac artery into the lower limb that supplies various parts of the lower limb and trunk (see Figure 4 on page 16)
   - **Popliteal artery**—A continuation of the femoral artery that passes through the knee and divides into eight branches that supply various muscles of the thigh, leg, and foot (see Figure 4 on page 16)
   - **Tibial arteries**—The anterior and posterior arteries that branch below the popliteal artery and supply the muscles of the lower leg (see Figure 4 on page 16)

KEY TERMS

Femoral (fe´-muh-ruhl)—Of or pertaining to the femur or the thigh

Popliteal (paw-pluh-te´-uhl)—Of or relating to the back part of the leg behind the knee joint

Tibial (ti´-be-uhl)—Pertaining to the largest long bone of the lower leg, the tibia

1250

Artery from the aortic arch	Body area(s) supplied
• Right subclavian	Right arm and the surrounding area
• Left subclavian	Left arm and the surrounding area
• Right carotid	Right side of the head, neck, and brain
• Left carotid	Left side of the head, neck, and brain
• Axillary	Various chest muscles and arm muscles
• Brachial	Upperarm
• Radial	Forearm, wrist, and hand
• Ulnar	Forearm, wrist, and hand
Artery from the thoracic aorta	**Body area(s) supplied**
• Bronchial	Bronchi
• Esophageal	Esophagus
• Pericardial	Pericardium
• Intercostal	Intercostal areas
• Mediastinal	Lymph glands and posterior mediastinum
• Superior/phrenic	Diaphragm
Artery from the abdominal aorta	**Body area(s) supplied**
• Celiac	Stomach, liver, and spleen
• Hepatic	Liver
• Splenic	Spleen
• Left gastric	Stomach
• Superior mesenteric	Small intestine
• Inferior mesenteric	Colon and rectum
• Middle suprarenal	Adrenal glands
• Renal	Kidneys, suprarenal glands, and the ureter
• Testicular	Testes and ureter
• Ovarian	Ovaries, part of the ureters, and the uterine tubes
• Inferior phrenic	Diaphragm and the esophagus
• Lumbar	Psoas muscles and part of the muscles of the abdominal wall
• Middle sacral	Sacrum and coccyx
Artery from the descending aorta	**Body area(s) supplied**
• Right and left common iliac	Ilium
• Internal iliac	Pelvic organs
• External iliac	Lower extremities
• Femoral	Various parts of the lower limb and trunk
• Popliteal	Various muscles of the thigh, leg, and foot
• Tibial	Muscles of the lower leg

Figure 3
Arteries of the systemic circulation system and the area(s) of the body supplied

OBJECTIVE 10

Label the major arteries of the systemic circulation system (see Figure 4).

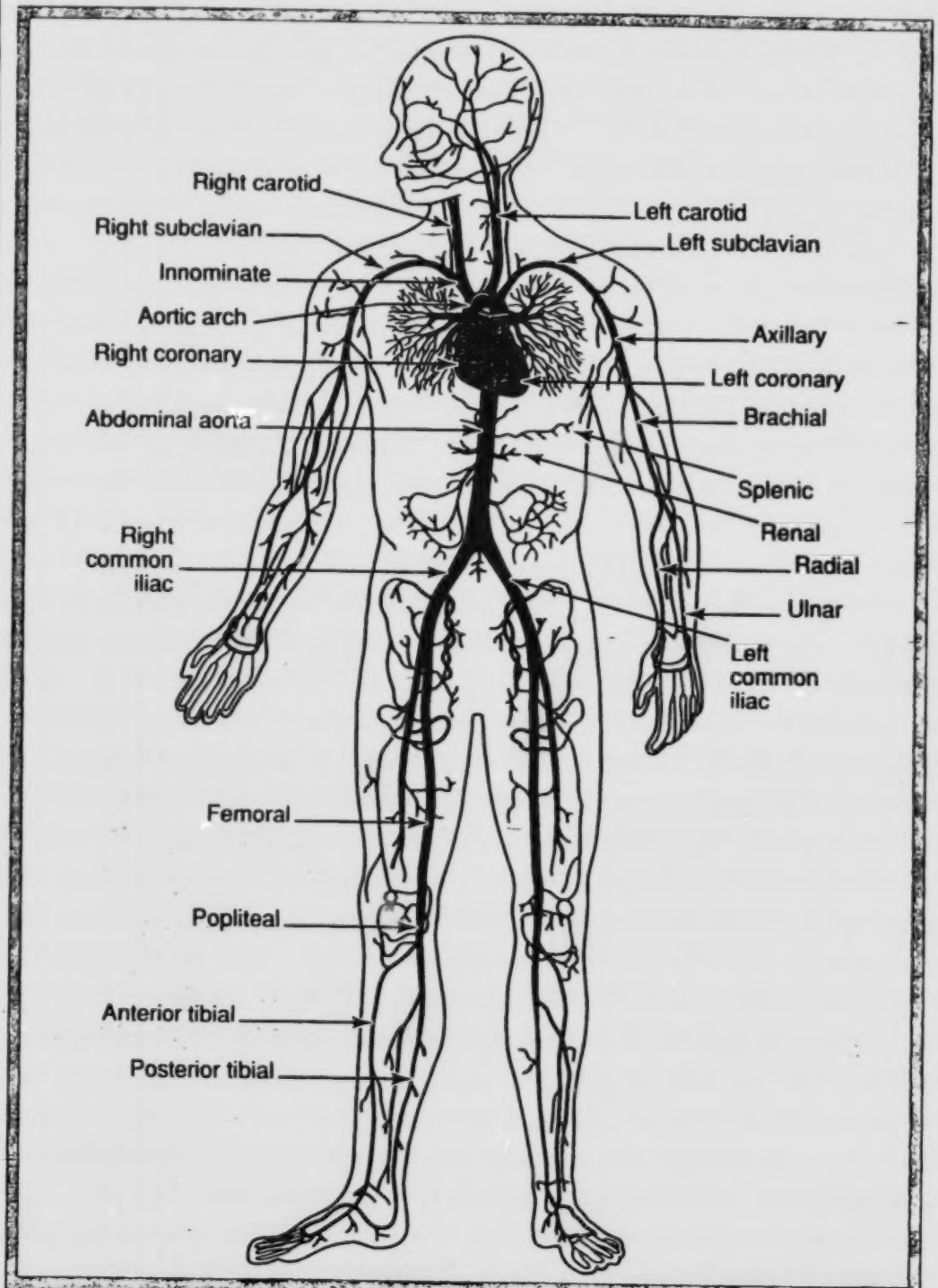


Figure 4
Major arteries of the systemic circulation system

OBJECTIVE 11 **Complete statements that describe the characteristics of capillaries.**

1. **Capillaries connect arterioles and venules.**
2. **Capillaries are minute vessels with walls that are only one cell layer thick.**

   ✔ **NOTE:** One square inch (6.3 square centimeters) of muscle tissue has more than 1.5 million capillaries.

3. **Nutrients and oxygen move from the capillaries through the capillary walls and into the cells of the body by osmosis.**
4. **Wastes move from the cells of the body through the capillary walls and into the capillaries by osmosis.**

OBJECTIVE 12 **Define the tissue layers of a vein** (see Figure 5 below).

1. **Tunica intima**—The innermost tissue layer of a vein that is composed of endothelium
2. **Tunica media**—The middle tissue layer of a vein that is composed of muscle tissue
3. **Tunica adventitia**—The outermost tissue layer of a vein composed of connective tissue

OBJECTIVE 13 **Label the tissue layers of a vein** (see Figure 5).

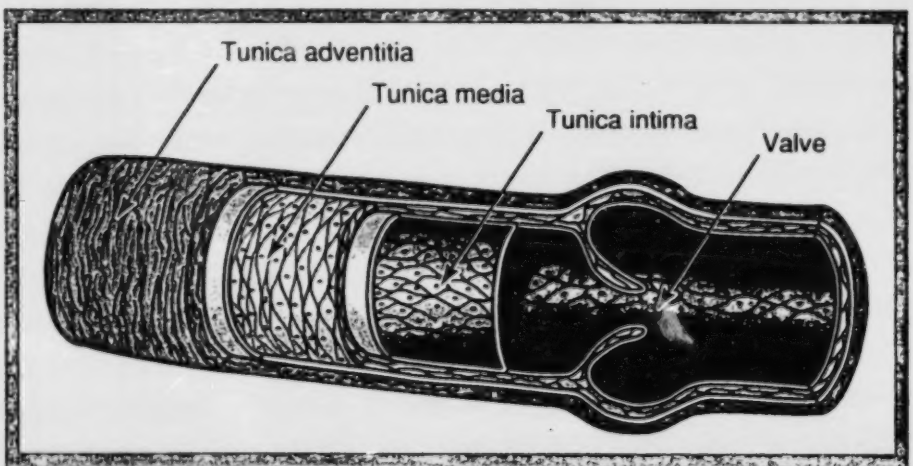


Figure 5
Tissue layers of a vein

OBJECTIVE 14 **Complete statements that describe the characteristics of veins.**

1. **Most veins carry deoxygenated blood to the vena cava of the heart; the pulmonary veins are an exception, as they carry oxygenated blood from the lungs to the heart.**

2. **Veins branch into venules and venules branch into capillaries.**
3. **The middle layer of muscle tissue in a vein is not very well developed or very flexible.**
4. **The wall of a vein is relatively thin, causing a vein to collapse when cut.**
5. **Many veins contain valves that prevent the backflow of blood** (see Figure 5 on page 17).
6. **Many veins share their names with the corresponding arteries.**

OBJECTIVE 15 **Define the major veins of the systemic circulation system** (see Figure 7 on page 21 and the chart in Figure 6 on page 20).

1. **Superior vena cava** (ve´-nuh ka´-vuh)—The large vein of the body that returns deoxygenated blood from the upper half of the body to the right atrium
2. **Inferior vena cava**—The large vein that returns deoxygenated blood to the heart from parts of the body below the diaphragm
3. **Innominate vein**—One of a pair of large veins on either side of the neck that is formed by the union of the internal **jugular** and subclavian veins and drains blood from the head, neck, and upper extremities and unites to form the superior vena cava

   ✔ **NOTE:** The innominate vein is also called the *brachiocephalic vein.*

KEY TERM

Jugular (juh´-gyuh-luhr)—Of or relating to the throat or neck

4. **Subclavian vein**—One of a pair of veins on either side of the body that is a continuation of the axillary vein in the upper body, extending near the clavicle, where it joins the internal jugular vein to form the innominate vein; the subclavian veins drain the upper extremities
5. **Axillary vein**—One of a pair of veins of the upper limb that is a continuation of the subclavian vein and drains deoxygenated blood from the area of the axilla
6. **Internal jugular vein**—One of a pair of veins in the neck that collects blood from the brain, superficial parts of the face, and neck; both veins unite with the subclavian vein to form the innominate vein
7. **External jugular vein**—One of a pair of large vessels in the neck that receives most of the blood from the exterior of the cranium and the deep tissues of the face
8. **Long thoracic vein**—One of a pair of long veins on each side of the body that collects blood from the lateral thoracic wall
9. **Hepatic veins**—The three main veins—the right, middle, and left—that drain the blood of the liver into the inferior vena cava

10. **Splenic vein**—A large vein of the lower body that returns blood from the spleen and part of the stomach

    ✔ **NOTE:** The splenic vein is also called the *lienal* (li´-uh-nuhl) *vein.*

11. **Portal vein**—The vein that **ramifies** in the liver and ends in capillary-like structures that convey the blood to the inferior vena cava through the hepatic veins; the vein collects blood from the digestive tract

    ✔ **NOTE:** In the adult, the portal vein has no valve, but in the fetus, the portal vein has valves that later atrophy and disappear.

12. **Superior mesenteric vein**—A tributary of the portal vein that drains blood from the small intestine, the **cecum**, and the ascending and the transverse colon

13. **Inferior mesenteric vein**—The vein in the lower body that returns blood from the **rectum**, the **sigmoid**, and descending parts of the colon

KEY TERMS

Ramify (ra´-muh-fi)—To branch into two or more parts, such as a branch of a nerve or artery

Cecum (se´-kuhm)—The pouch at the beginning of the large intestine

Rectum (rek´-tuhm)—The terminal part of the intestine

Sigmoid (sig´-moid)—Curved like the letter C; the portion of the colon that extends from the end of the descending colon in the pelvis to the juncture of the rectum

14. **Common iliac vein**—One of two veins on the left and right side of the body that are the sources of the inferior vena cava and drains blood from the pelvis and the legs

15. **Femoral vein**—A large vein in the thigh that drains blood from the area of the thigh

16. **Great saphenous vein**—One of a pair of the longest veins in the body that courses through the leg and thigh before ending in the femoral vein; the vein drains blood from the **dorsum** of the foot to the femoral vein just below the **inguinal** ligament

KEY TERMS

Saphenous (suh-fe´-nuhs)—Of or relating to the two chief veins of the legs

Dorsum (dor´-suhm)—The upper surface of an appendage or part

Inguinal (in´-gwuh-nuhl)—Of or relating to or situated in the region of the groin or in either of the lowest lateral regions of the abdomen

Vein	Drains blood from
• Supeior vena cava	Upper half of the body
• Inferior vena cava	Lower half of the body below the diaphragm
• Innominate	Head, neck, and upper extremities
• Subclavian	Upper extremities
• Axillary	Axilla area
• Internal jugular	Brain, superficial parts of the face, and the neck
• External jugular	Exterior of the cranium and deep tissues of the face
• Long thoracic	Lateral thoracic wall
• Hepatic	Liver
• Splenic	Spleen and part of the stomach
• Portal	Digestive track
• Superior mesenteric	Small intestine, cecum, and the ascending and transverse colon
• Inferior mesenteric	Rectum, sigmoid, and descending parts of the colon
• Common iliac	Pelvis and legs
• Femoral	Thigh
• Great saphenous	Dorsum of the foot to the femoral vein just below the inguinal ligament

Figure 6
Veins of the systemic circulation system and the area(s) of the body drained

OBJECTIVE 16

Label the major veins of the systemic circulation system (see Figure 7).

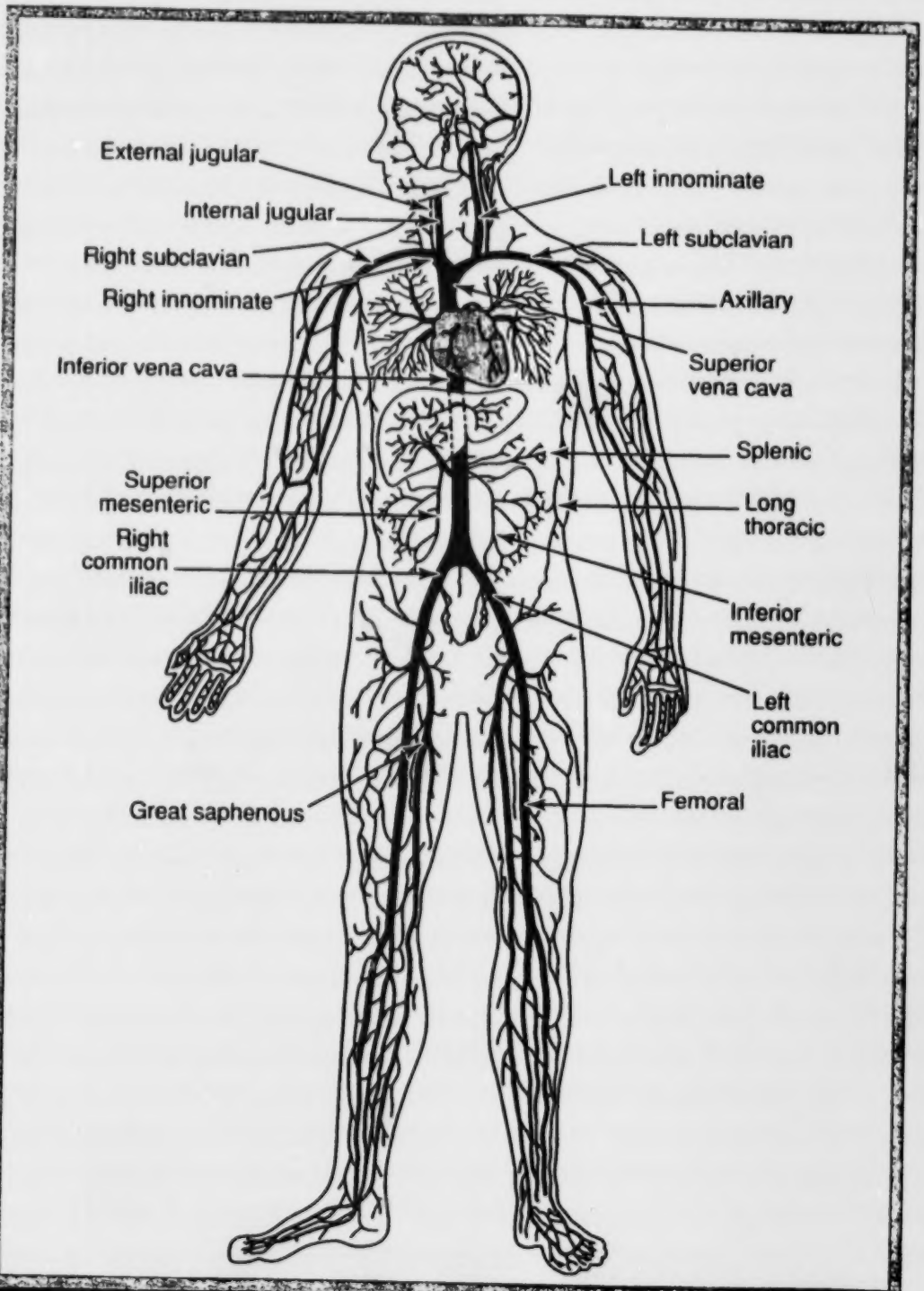


Figure 7
Major veins of the systemic circulation system

OBJECTIVE 17

Define the term *portal circulation system.*

■ **Portal circulation system**—The portion of the systemic circulation system that provides the pathway of blood flow from the gastrointestinal tract and spleen to the liver via the portal vein and its tributaries (see Figure 8 below)

✔ **NOTE:** Portal circulation picks up nutrients and other compounds from the digestive system and then takes them to the liver to be detoxified. A principal function of the liver is to remove toxic substances from the blood before it returns to the heart.

OBJECTIVE 18

Complete statements that describe the characteristics of the portal circulation system (see Figure 8 below).

1. **Veins from the stomach, intestines, spleen, and pancreas empty into the portal vein.**
2. **The portal vein then carries the blood loaded with digested food products to the liver, where the food is altered, stored, and released as needed.**
3. **The liver removes toxins from the blood.**
4. **Blood leaves the liver through the hepatic veins, which empty into the inferior vena cava.**

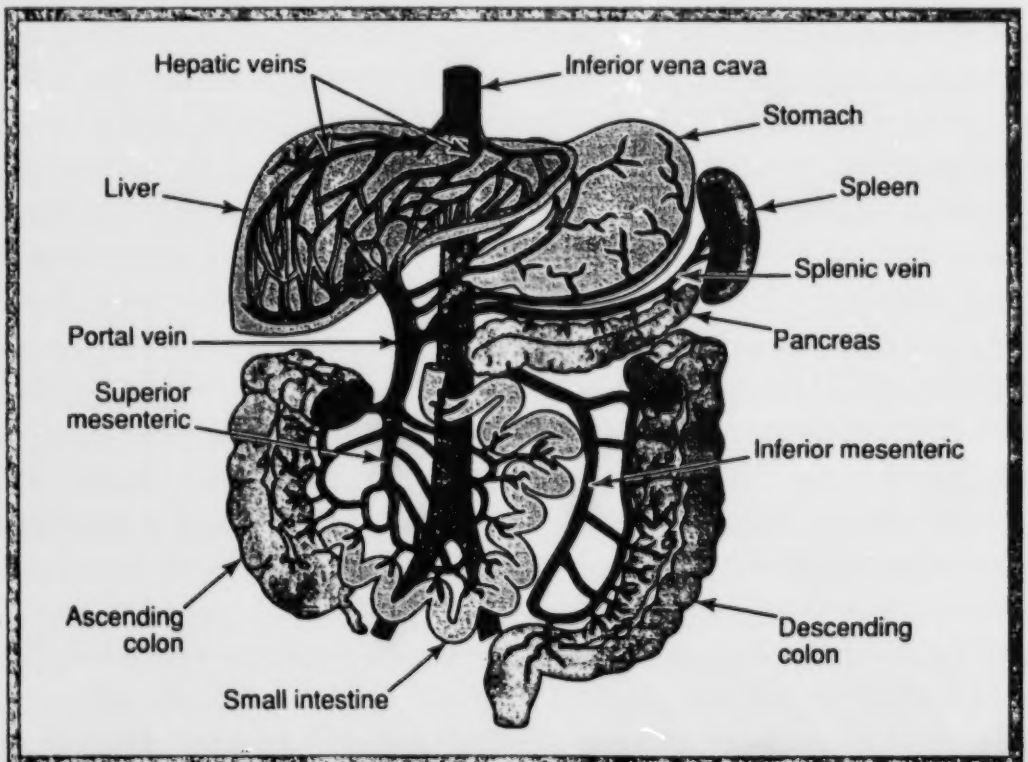


Figure 8
Major structures of the portal circulation system

OBJECTIVE 19

Define the term *pulse point.*

- **Pulse point**—Any one of the sites on the surface of the body where arterial pulsations can be easily felt

✔ **NOTE:** One of the indicators of health is the rate of the heartbeat. While a caregiver can listen to the heart beating with a stethoscope, the beat itself can be monitored at other points in the body that are more convenient to check and easier to monitor without interference from clothing and the heavy structure of the chest. These places are known as *pulse points* (see Figure 9 on page 24). At the pulse points, the contractions of the heart can be felt as a vibration through the walls of the arteries at points where the arteries are near the surface of the body.

OBJECTIVE 20

State the normal pulse rate of a healthy adult at rest.

- **Normal pulse rate**—Between 60 to 80 beats per minute

✔ **NOTE:** Persons who work out may have slower heart rates due to increased heart volume. The rate will also vary with exercise, health, age, and other factors. When checking the pulse, the caregiver should also note whether the pulse is regular and whether the pulse is weak or strong.

OBJECTIVE 21 **Label the common pulse points** (see Figure 9).

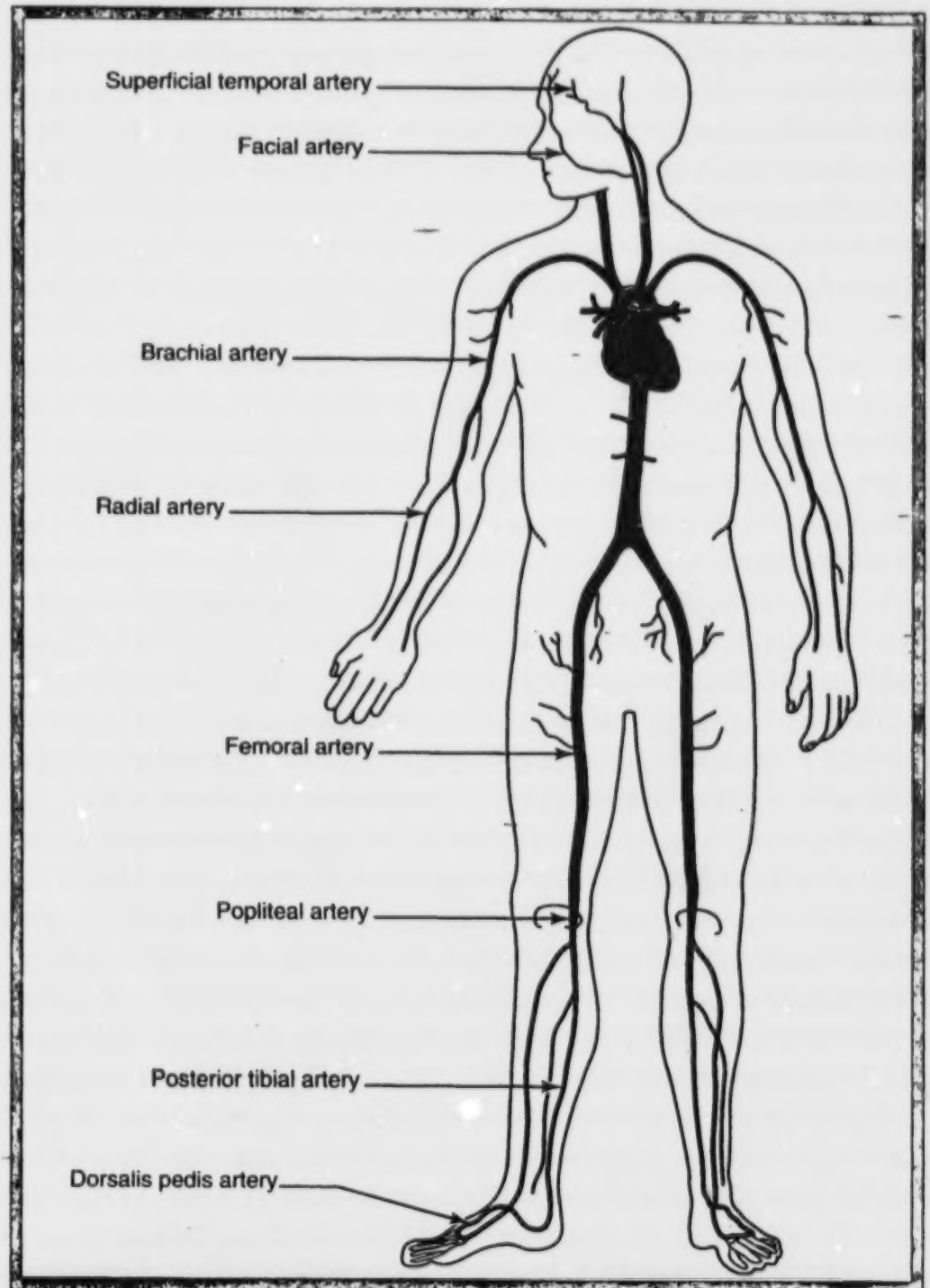


Figure 9
Common pulse points

OBJECTIVE 22 **Define the term *blood pressure*.**

- **Blood pressure**—The pressure exerted by the circulating volume of blood on the walls of the arteries, the veins, and the chambers of the heart

OBJECTIVE 23 **Complete statements that describe how blood pressure is measured.**

1. **Blood pressure is created by the contraction of the ventricles in the heart.**
2. **The conventional measurement of blood pressure is in millimeters of mercury (mm Hg), a measure of the force required to raise a column of liquid mercury in a tube.**
3. **Two points are taken in measuring blood pressure: the systole** (sis´-tuh-le) **and the diastole** (di´-as-tuh-le).
4. **The systole is the contraction of the myocardium, which in ventricular contraction, causes blood to be pumped into the arteries.**
5. **The diastole is the dilation of the cavities of the heart during which they fill with blood.**
6. **The pressure in the aorta and the large arteries of a healthy young adult is approximately 120 mm Hg during systole and 70 mm Hg in diastole.**
7. **Blood-pressure measurements are always given stating the systole first and the diastole second.**

   Example: 120 over 70 or 120/70

OBJECTIVE 24 **Describe the factors that affect blood pressure.**

1. **Heart force**—Heart force is one of the contributors of cardiac output, which includes both the amount of blood pumped and the force of the pumping action with each contraction. Abnormally hard contractions can lead to increased heart force and higher blood pressure; weak pumping in the heart will cause lowered blood pressure.
2. **Heart rate**—Increased heart rates result in lower blood pressure. As the heart beats faster, there is less time for the ventricles to fill with blood between contractions. Consequently, the blood-volume output of the heart is reduced and blood pressure goes down.
3. **Peripheral vascular resistance**—A greater amount of capillaries or other narrow vessels leads to an increase in blood pressure. The heart pumps blood through the blood vessels. However, because blood vessels grow ever narrower as the blood flows away from the heart, the vessels resist the flow of blood through them. This resistance is increased when the blood vessels become reduced in diameter. This may occur naturally with the constriction of blood vessels when the body is hot and as the arteries become peripheral capillaries or as a health factor as when fat builds up inside the blood vessels. Also, increased body mass along with the increase in capillary networks may lead to increased blood pressure.

4. **Elasticity of arteries**—A reduction in the elasticity of the arteries leads to increased blood pressure. The arteries are somewhat elastic and stretch as blood is forced through them. However, as a person ages or in certain disease conditions, some of this elasticity is lost. With reduced elasticity, blood pressure increases.

5. **Blood volume**—A loss in blood volume leads to lower blood pressure. If a person suffers a loss of blood or experiences internal bleeding, blood pressure will drop.

6. **Blood viscosity**—If the blood thickens, blood pressure will increase; if the blood grows thinner, blood pressure will decrease.The normal constituents of blood—red and white cells and plasma—produce a flowing liquid that can easily move through the circulatory system. However, environmental conditions or disease can cause an imbalance in blood components that results in blood being too thick or too thin. For example, smoking leads to an excess of red blood cells, which can cause high blood pressure. Some forms of anemia result in low red-blood-cell counts and low blood pressure.

7. **Hormones**—Hormonal imbalances may lead to increases or decreases in blood pressure. While the mechanism behind blood-pressure regulation is not fully understood, the body uses hormones to help regulate blood pressure, often by constricting or relaxing the blood vessels. If these hormones become unbalanced because of stress or disease, abnormal blood pressure may persist.

8. **Chemicals**—Chemicals present in the blood may lead to increases or decreases in blood pressure. In the same way that hormones regulate blood pressure, chemicals entering the body may disrupt normal blood-pressure mechanisms. These may include drugs specifically intended to affect blood pressure or chemicals that do so as a by-product of other physiological effects.

OBJECTIVE 25 **Complete statements that describe the characteristics of the fetal circulation system.**

✔ **NOTE:** When a woman is pregnant, the developing fetus is dependent on its mother's blood supply for all the nutrients and oxygen that are carried in the blood. So while the fetus develops a circulatory system, an exchange of oxygen and nutrients as well as metabolic wastes must occur between the fetus and the mother. The fetus and the mother have independent blood systems that do not intermingle. Additionally, the fetal heart beats, but its circulatory path is not the same as it will be after birth.

1. **The fetus depends on the mother for circulation of blood, the intake of oxygen and nutrients, and the removal of carbon dioxide and waste products.**

2. **In the placenta, the mother's blood vessels and those of the fetus come very close to each other; in this region, materials move between the two circulatory systems by diffusion through the walls of the blood vessels and by active-transport mechanisms.**

KEY TERM

Placenta (pluh-sen´-tuh)—A special organ that forms in the uterus during pregnancy, serves as the site of exchange between the mother's blood and the fetus' blood, and consists of tissue from both the mother and the fetus

3. **The placenta is joined to the fetus by the umbilical** (uhm-bi´-li-kuhl) **cord, a sheath that covers the umbilical blood vessels; the umbilical blood vessels consist of one vein and two arteries.**

4. **The umbilical arteries are branches of the fetus' internal iliac arteries and allow deoxygenated fetal blood to flow to the placenta, where it becomes enriched with oxygen and nutrients.**

5. **The enriched blood flows from the placenta to the fetus in the umbilical vein.**

6. **Some of the venous blood flows to the fetal liver, but most flows to the heart through the ductus venosus** (duhk´-tuhs ve´-no-suhs) **and into the inferior vena cava.**

7. **Blood enters the right atrium of the fetal heart.**

8. **The fetal heart contains an opening between the right and left atria called the *foramen ovale*** (o-va´-le)**, allowing some blood to flow to the left atrium.**

9. **The pumping of the right ventricle pushes blood into the pulmonary artery; however, a special fetal blood vessel called the *ductus arteriosus*** (awr-tir-e-o´-suhs) **diverts blood to the body and away from the fetal lungs, which are collapsed during gestation.**

10. **When the baby begins breathing after delivery, the expansion of the lungs pulls blood into the pulmonary artery and to the lungs.**

11. **Blood returning from the lungs to the left atrium causes a flap to close over the foramen ovale, which seals within a few days.**

12. **The ductus arteriosus constricts as pulmonary flow increases.**

13. **The umbilical veins and arteries constrict once blood stops flowing through them.**

OBJECTIVE 26 **Define common disorders and abnormalities of the vascular system.**

1. **Arteriosclerosis** (awr-tir-e-o-skluh-ro´-suhs)—A common arterial disorder characterized by thickening and loss of elasticity, resulting in a decreased blood supply, especially to the cerebrum and the lower extremities

   ✔ **NOTE:** Typical signs and symptoms of arteriosclerosis include cramp-like pain in the calves caused by poor circulation of the blood to the leg muscles, changes in skin temperature and color, headache, dizziness, and memory defects.

2. **Atherosclerosis** (a-thuh-ro-skluh-ro´-suhs)—A common arterial disorder characterized by yellowish plaque in the inner layers of the walls of large- and medium-sized arteries, causing the vessel walls to thicken and narrow, resulting in reduced blood flow to organs normally supplied by the artery

   ✔ **NOTE:** Atherosclerosis is the major cause of coronary heart disease, angina pectoris, myocardial infarction, and other cardiac disorders.

3. **Aneurysm** (an´-yuh-ri-zuhm)—A localized sac or bubble that forms at a weak spot in the wall of a blood vessel

   ✔ **NOTE:** Aneurysms are usually caused by atherosclerosis and hypertension, or less frequently, by trauma, infection, or a congenital weakness in a vessel wall. If an aneurysm ruptures, it may cause hemorrhage.

4. **Phlebitis** (fli-bi´-tuhs)—Inflammation of a vein that is often accompanied by the formation of a clot

   ✔ **NOTE:** Phlebitis is also called *thrombophlebitis*.

5. **Varicose veins** (var´-uh-kos vans´)—Abnormally large, dilated veins that typically occur in the legs and are caused by congenitally defective valves, phlebitis, pregnancy, and obesity

6. **Hemorrhoids** (he´-muh-roids)—A condition caused by abnormally dilated veins in the anal canal

7. **Hypertension** (hi-puhr-ten´-shuhn)—A condition in which blood pressure is consistently higher than 140/90 millimeters of mercury

   ✔ **NOTE:** Hypertension commonly has no symptoms other than consistently elevated blood pressure.

8. **Circulatory shock** (suhr´-kyuh-luh-tor-e shawk´)—The general term for any of the various conditions that result in decreased cardiac output and the deprivation of oxygen and nutrients to tissues

9. **Septic shock** (sep´-tik shawk´)—Circulatory shock that occurs as a result of a bacterial infection

OBJECTIVE 27

Assignment Sheet 1—Practice Critical Thinking: Determine Cause-and-Effect Relationships Related to the Circulatory System

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

The circulatory system is amazingly simple and wondrously complex. In essence, the system is somewhat like a toy train going around in circles, coming back to the same place over and over as the heart pumps blood in a continuous course through the body. Yet, during each pass, the blood carries a marvelous batch of chemicals that feed our cells, provide them with oxygen, protect them from disease, regulate their functioning, carry away their wastes, provide them with warmth and moisture, and much more. Understanding how these feats are achieved will help you have a better picture of the overall anatomy and physiology of the body. In this assignment sheet, you will be presented with information about the circulatory system and then will be asked to offer explanations for these facts based on what you have learned.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Read the investigation points on the next page. Your investigative report must include answers to all three of these investigation points.

_____ 3. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided below.

_____ 4. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 5. Complete your investigation and give your investigative report to your instructor for evaluation.

Format of investigative report _____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

INVESTIGATION POINT 1

Varicose veins occur when the walls of veins become stretched. For example, someone who stands for long periods of time may develop varicose veins because the blood pools in her or his legs, expanding the veins and often stretching the valves to the point that they no longer close completely. Hemorrhoids are a type of varicose veins that occur in the anal canal. Hemorrhoids often occur in women as a result of a pregnancy. What is the probable explanation of why this would occur?

INVESTIGATION POINT 2

One possible side effect of hypertension is referred to as *left ventricular hypertrophy*. Hypertrophy is an increase in muscle size as a result of exercise. While strengthened muscles are generally a good condition, left ventricular hypertrophy can lead to heart attacks. What causes left ventricular hypertrophy and why may it lead to an increased risk of heart attacks?

INVESTIGATION POINT 3

The following medicines are often given for circulatory disorders. The descriptions below also give a few key points about the reasons these medications are used. Based on the information presented, what physiological explanation is there for why the medication may be helpful?

a. Beta-adrenergic blockers block norepinephrine receptors.

b. Calcium blockers reduce the flow of calcium in the heart.

c. Nitroglycerine dilates the coronary blood vessels and is often given to someone having myocardial infarction.

MODULE SET II:
Major Body Systems

Module 10: Lymphatic System

1267

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Investigate the Involvement of the Lymphatic System in Interventions for Cancer	19

1263

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

❑	1.	**Take**	Pretest provided by your instructor.
❑	2.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
❑	3.	**Read**	Module Objective Sheet.
❑	4.	**Study**	Information Sheet, Objective 1 through Objective 18.
❑	5.	**Research**	Online resources to learn more about the lymphatic system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

❑	6.	**Take**	Written Test provided by your instructor.
❑	7.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
❑	8.	**Do**	Assignment Sheet 1, "Practice Critical Thinking: Investigate the Involvement of the Lymphatic System in Interventions for Cancer."
❑	9.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
❑	10.	**Check**	With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the lymphatic system and define common disorders and abnormalities of the lymphatic system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *lymphatic system.*
2. List the major structures of the lymphatic system.
3. Label the major structures of the lymphatic system.
4. State the sequence of lymph circulation through the major structures of the lymphatic system.
5. Complete statements that describe the characteristics of lymph and its movement through the body.
6. Complete statements that describe the characteristics of lymphatic capillaries.
7. Complete statements that describe the characteristics of lymphatic vessels.
8. Complete statements that describe the characteristics of lymph nodes.
9. Define the major groups of lymph nodes.
10. Label the major groups of lymph nodes.
11. Define the major lymphatic ducts.
12. Label the major lymphatic ducts.
13. Define the term *lymph nodule.*
14. Complete statements that describe the characteristics of the spleen.
15. Complete statements that describe the characteristics of the thymus.
16. Complete statements that describe the characteristics of the tonsils.
17. Label the tonsils of the mouth and throat.
18. Define common disorders and abnormalities of the lymphatic system.
19. Practice critical thinking: investigate the involvement of the lymphatic system in interventions for cancer. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1 **Define the term *lymphatic system.***

■ **Lymphatic** (lim-fa´-tik) **system**—The vast, complex network of capillaries, thin vessels, valves, ducts, nodes, and organs that helps to protect and maintain the internal fluid environment of the entire body by producing, filtering, and conveying lymph and by producing various blood cells (see Figure 1 on the next page)

✔ **NOTE:** The lymphatic system consists of the lymphatic vessels, the fluid that flows through them, specialized structures called *nodes*, and organs that include the spleen and the thymus, which you will study in the following objectives. The lymphatic vessels are distributed throughout the body so that specific areas of the vessel network drain **interstitial** fluid from adjacent areas of the body.

The lymphatic system is closely related to the circulation of blood in the body and is in reality an extension of the circulatory system with complementary functions. Although the lymphatic system is treated in this module as a separate system, keep in mind that the flow of blood and the flow of lymph interact with each other.

In previous modules about the circulatory system, you have studied how the blood carries oxygen and nutrients throughout the body to support cell metabolism. You know that oxygen and nutrients pass through the walls of the capillaries to nourish the cells. Recall also that cells and capillaries are surrounded by interstitial fluid. Blood plasma helps to carry oxygen and nutrients into the interstitial fluid. Similarly, waste products and carbon dioxide exit the cells and accumulate in the interstitial fluid. Most of these wastes are absorbed by the venous capillaries and recirculated. However, some of the plasma and cell fluids remain in the interstitial fluid. One function of the lymphatic system is to absorb excess interstitial fluid and return it to the veins, thus maintaining fluid balance within the body.

In Module 3 in Module Set I, you studied about the body's immune system. Part of that system consists of specialized cells referred to as *lymphocytes* that serve various roles in fighting infections. Lymphocytes are produced within the lymphatic system.

KEY TERM

Interstitial (in-tuhr-sti´-shuhl)—Situated within but not restricted to or characteristic of a particular organ or tissue

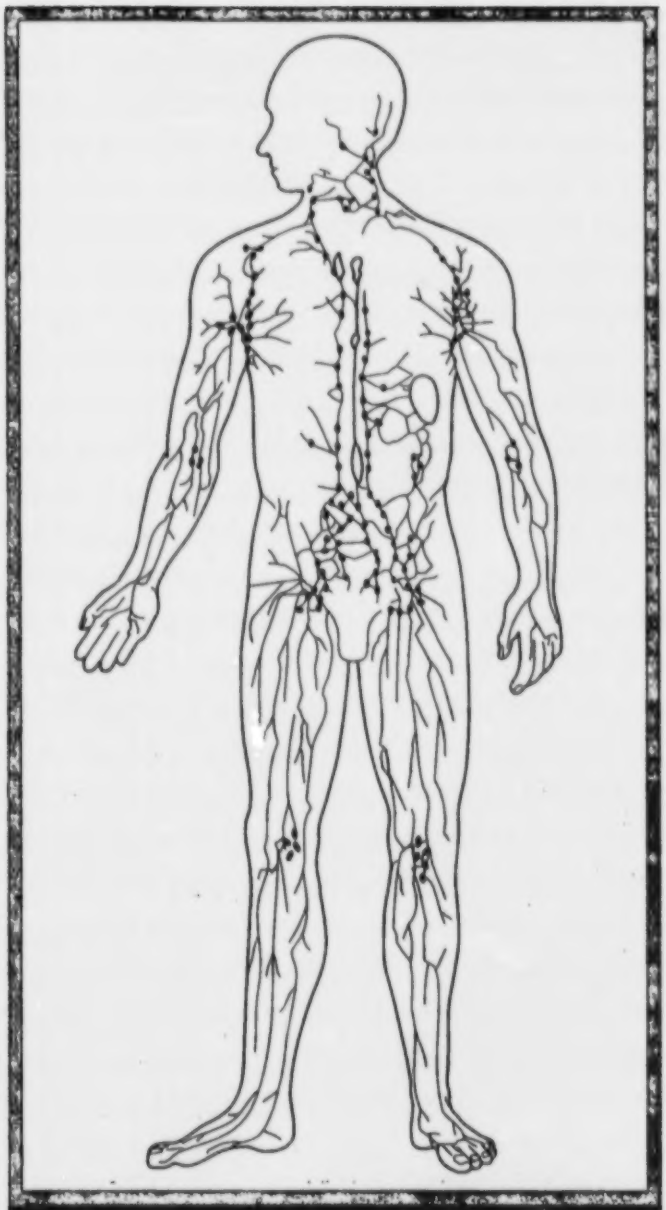


Figure 1
Lymphatic system

OBJECTIVE 2 **List the major structures of the lymphatic system.**

1. **Lymphatic capillaries**

   ✔ **NOTE:** Lymphatic capillaries are the numerous, small lymphatic vessels that form networks throughout the tissue spaces in the body. You will study more about the lymphatic capillaries in Objective 6.

2. ***Lymphatic vessels***

✔ **NOTE:** In Module 7, you learned the definitions of many of the major structures of the lymphatic system. Some of those definitions are repeated here in this and the following notes. Lymphatic vessels (also called *lymph vessels*) are fine, transparent, valved channels that carry lymph and tissue fluid, are distributed through most tissues, and are characterized by a beaded appearance (see Figure 1 on page 8 and Figure 2 on the next page). You will study more about the lymphatic vessels in Objective 7.

3. **Lymph nodes**

✔ **NOTE:** Lymph nodes are small, oval structures that filter lymph, fight infection, and form lymphocytes, monocytes, and plasma cells (see Figure 2 on the next page). Lymph flows into a node through **afferent** lymphatic vessels and flows out of a node through **efferent** lymphatic vessels (see Figure 3 on page 11). You will study more about the lymph nodes in Objective 8 through Objective 10.

KEY TERMS

Afferent (a´-fuh-ruhnt)—Bearing or conducting inward

Efferent (e´-fuhr-uhnt)—Conducting outward from a part

4. **Major lymphatic ducts**

✔ **NOTE:** There are two major lymphatic ducts in the body: the right lymphatic duct and the thoracic duct (see Figure 5 on page 14). You will study more about the major lymphatic ducts in Objective 11 and Objective 12.

5. **Spleen**

✔ **NOTE:** The spleen is a soft, highly vascular organ located in the upper left quadrant of the abdominal cavity, just below the diaphragm and behind the stomach (see Figure 2 on the next page); it produces leukocytes, monocytes, lymphocytes, and plasma cells; stores blood cells; and filters out bacteria and wornout red blood cells. You will study more about the spleen in Objective 14.

6. **Thymus**

✔ **NOTE:** The thymus is the glandular structure of largely lymphoid tissue that is located in the upper chest or at the base of the neck (see Figure 2 on the next page) and functions especially in the development of the body's immune system. You will study more about the thymus in Objective 15.

7. **Tonsils**

✔ **NOTE:** The tonsils are the masses of lymphoid tissue that are located in the back of the mouth, in the throat (see Figure 2 on the next page), and in the mucous membrane of the **ileum**. You will study more about the types of tonsils in Objective 16 and Objective 17.

KEY TERM

Ileum (i´-le-uhm)—The last division of the small intestine

OBJECTIVE 3

Label the major structures of the lymphatic system (see Figure 2).

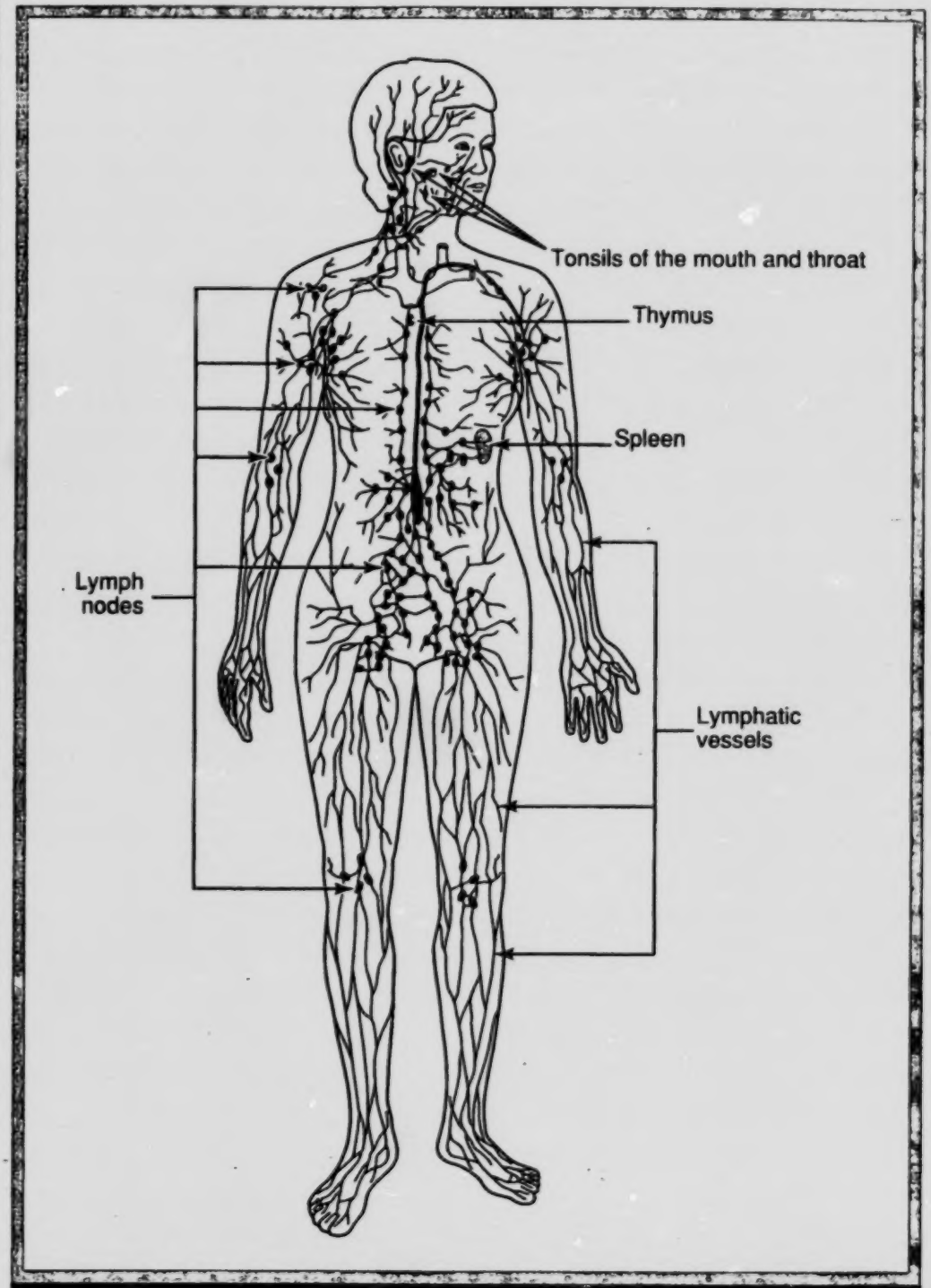


Figure 2.
Major structures of the lymphatic system

OBJECTIVE 4

State the sequence of lymph circulation through the major structures of the lymphatic system (see Figure 3).

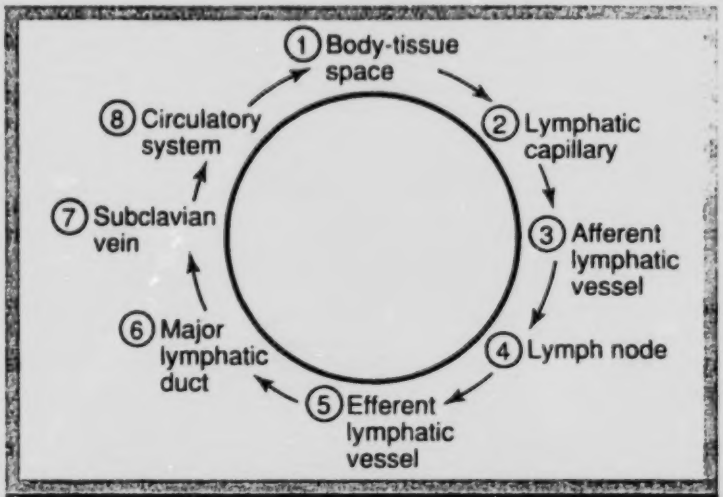


Figure 3
Sequence of lymph circulation through the lymphatic system

OBJECTIVE 5

Complete statements that describe the characteristics of lymph and its movement through the body.

1. **Lymph is a dynamic fluid that varies in appearance and composition depending on the location in the body, the health of the individual, diet, and many other factors.**
2. **Lymph is a clear, colorless fluid though it may become milky where the lymphatic vessels drain into the intestines, due to the accumulation of fat.**
3. **Lymph differs from blood in that the red blood cells are absent.**
4. **Lymph resembles plasma in composition but contains less protein.**

   ✔ **NOTE:** Lymph is nearly identical to the interstitial fluid of the region of the body in which the lymph occurs.

5. **The lymphatic system has no pump to force movement; movement of lymph is caused by breathing and by the contractions of the skeletal system.**
6. **Lymph moves slowly and in one direction because the lymphatic vessels contain one-way valves that prevent the lymph from backflowing.**

OBJECTIVE 6

Complete statements that describe the characteristics of lymphatic capillaries.

1. **Lymphatic capillaries are the smallest lymphatic vessels and carry lymph from the tissue spaces to larger lymphatic vessels** (see Figure 2 on page 10).
2. **Unlike blood capillaries, lymphatic capillaries do not bridge two larger vessels since one end lies in a pool of tissue fluid and the other connects to a larger lymphatic vessel.**

3. **Like blood capillaries, lymphatic capillaries consist of one layer of flattened epithelial cells.**

OBJECTIVE 7 **Complete statements that describe the characteristics of lymphatic vessels.**

1. **Lymphatic vessels are thin-walled, very permeable vessels that convey lymph from lymphatic capillaries to lymph nodes and from lymph nodes to lymphatic ducts** (see Figure 2 on page 10).

2. **Lymphatic vessels resemble veins in that they consist of three tissue layers and have valves to prevent backflow and keep lymph moving in only one direction.**

OBJECTIVE 8 **Complete statements that describe the characteristics of lymph nodes.**

1. **Lymph nodes are deep or superficial masses of lymphoid tissue found along the lymphatic system** (see Figure 2 on page 10).

2. **Specific lymph nodes are identified by their location in the body** (see Objective 9 and Objective 10).

3. **Lymph nodes may be an inch (2.5 centimeters) in length.**

4. **Lymph nodes produce lymphocytes and monocytes.**

5. **Lymph nodes serve as filters to keep substances such as bacteria from entering the bloodstream.**

OBJECTIVE 9 **Define the major groups of lymph nodes** (see Figure 4 on the next page).

✔ **NOTE:** While there are many different kinds of lymph nodes, three groups of lymph nodes are especially important: (1) the cervical nodes, (2) the axillary nodes, and (3) the inguinal nodes. These groups of nodes are important because they isolate the vital organs of the trunk from the head and the extremities. The purpose of this isolation is to prevent infections from spreading to the vital organs from likely sites of infection. For example, infections are likely to begin in the nose, mouth, ears, and eyes. They are also likely to occur in the sites of injuries in the extremities. The major lymph-node groups provide an increased level of protection against these infections.

1. **Cervical nodes**—The major group of lymph nodes located on each side of the neck; the nodes on the right side of the head and neck drain into the right lymphatic duct, and the nodes on the left side of the head and neck drain into the thoracic duct

   ✔ **NOTE:** You will study the lymphatic ducts in Objective 11.

   ✔ **NOTE:** The swelling of the cervical lymph nodes during an infection of streptococcus is what is often referred to as *swollen glands* with strep throat.

2. **Axillary nodes**—The major group of lymph nodes located in the left and right armpits; the nodes in the right thorax and arm drain into the right lymphatic duct, and the nodes in the left thorax and arm drain into the thoracic duct

3. **Inguinal nodes**—The major group of lymph nodes located in the region of the groin; the nodes drain the lower extremities and external genital organs into the thoracic duct

OBJECTIVE 10

Label the major groups of lymph nodes (see Figure 4).

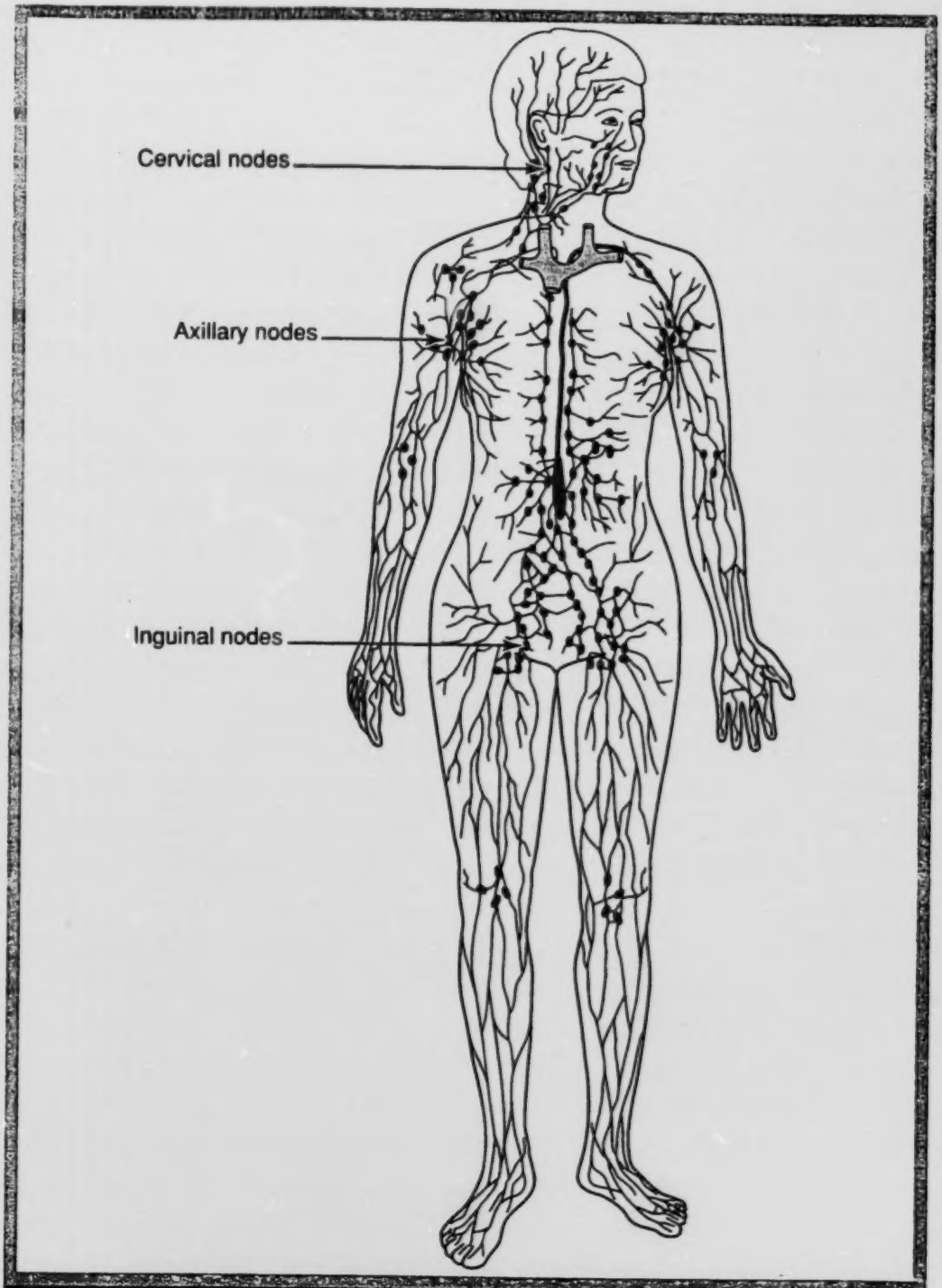


Figure 4
Major groups of lymph nodes

OBJECTIVE 11

Define the major lymphatic ducts (see Figure 5 below).

1. **Right lymphatic duct**—The major lymphatic vessel that conveys lymph from the right upper quadrant—head, neck, thorax, and upper extremity—of the body into the right subclavian vein

2. **Thoracic duct**—The common trunk of all the lymphatic vessels in the body, except those on the right upper quadrant of the body; it begins in the abdomen, travels through the thorax, ascends into the neck, over the clavicle, and into the left subclavian vein

OBJECTIVE 12

Label the major lymphatic ducts (see Figure 5).

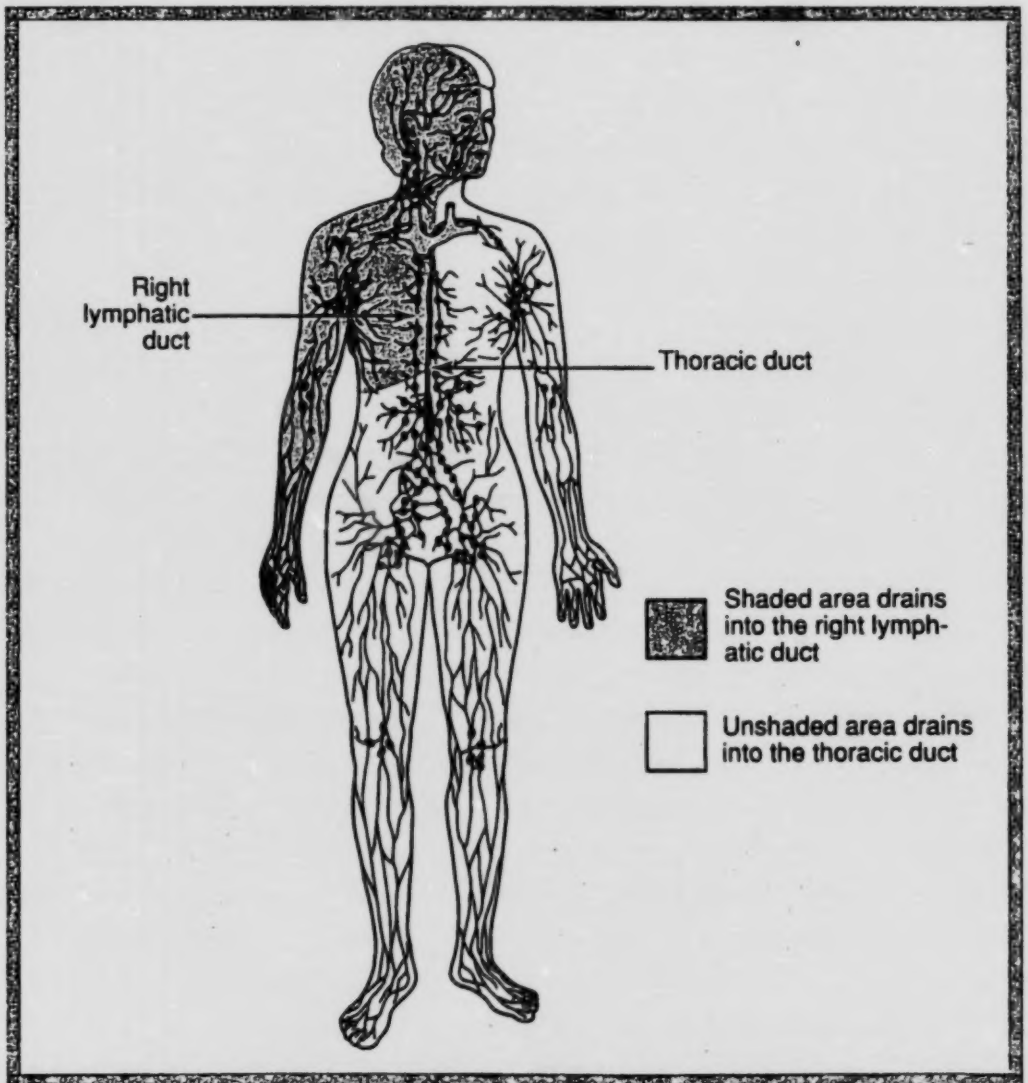

Right lymphatic duct
Thoracic duct
Shaded area drains into the right lymphatic duct
Unshaded area drains into the thoracic duct

Figure 5
Area of drainage of the major lymphatic ducts

OBJECTIVE 13

Define the term *lymph nodule*.

- **Lymph nodule**—Any of the tiny, densely packed spherical nodes or aggregates of lymph cells embedded mainly in the tonsils, spleen, and thymus

✔ **NOTE:** Lymph nodes may be an inch (2.5 centimeters) in length, but lymph nodules may be as small as a pinhead.

OBJECTIVE 14

Complete statements that describe the characteristics of the spleen.

1. **The spleen is the largest mass of lymphoid tissue in the body; it is located in the upper left quadrant of the abdominal cavity behind the stomach.**
2. **The spleen is 5 to 6 inches (12.5 to 15 centimeters) long and 2 to 3 inches (5 to 7.5 centimeters) wide and is soft, spongy, and purplish in color.**
3. **The spleen produces erythrocytes in a fetus and lymphocytes and monocytes in adults.**
4. **The spleen filters cancer cells and other particulate matter and filters and destroys bacteria and wornout red blood cells.**
5. **The spleen contains plasma cells that produce antibodies.**
6. **The spleen has an unusually large blood supply in relation to its size, and it stores about 11⅘ cubic inches (350 cubic centimeters) of blood that can be returned to the bloodstream in case of a hemorrhage or other emergency.**
7. **The spleen can be removed without severe adverse effects because other body parts such as the liver and bone marrow can perform the spleen's functions.**

OBJECTIVE 15

Complete statements that describe the characteristics of the thymus.

1. **The thymus is a two-lobed organ located in the upper part of the chest cavity along the trachea inferior to the thyroid and posterior to the sternum.**
2. **The thymus is the largest and most active during prenatal life and infancy, but it decreases in size and activity after puberty and is replaced by connective tissue.**
3. **The thymus produces lymphocytes (T cells), which function in the body's defenses against infection, especially during prenatal life and infancy, and secretes thymosin, which is necessary for the maturity of T cells and for the growth of lymphoid tissue throughout the body.**

OBJECTIVE 16

Complete statements that describe the characteristics of the tonsils.

1. **Tonsils are small, rounded masses of lymphoid tissue.**

2. **There are four major groups of tonsils: the pharyngeal tonsils, the palatine tonsils, the lingual tonsils, and the intestinal tonsils.**

KEY TERMS

Pharyngeal (fuh-rin´-juhl)—Pertaining to the pharynx (the throat)

Palatine (pa´-luh-tin)—Pertaining to the palate, the structure that forms the roof of the mouth

Lingual (lin´-gwuhl)—Pertaining to the tongue

3. **The pharyngeal, palatine, and lingual tonsils are located in the back of the mouth and in the throat.**

4. **The pharyngeal tonsils are a pair of almond-shaped masses each located behind the nose and on the roof of the posterior wall of the pharynx** (see Figure 6 on the next page).

   ✔ **NOTE:** The pharyngeal tonsils are commonly called the *adenoids.*

5. **The palatine tonsils are a pair of tonsils each located in the back of the mouth on the lateral walls of the pharynx** (see Figure 6 on the next page).

   ✔ **NOTE:** The palatine tonsils are commonly called *the tonsils.*

6. **The lingual tonsil is a mass of lymph tissue near the root of the tongue** (see Figure 6 on the next page).

7. **The intestinal tonsils are a group of lymphatic nodules forming a single layer in the mucous membrane of the ileum.**

   ✔ **NOTE:** The intestinal tonsils—also called *Peyer's patches*—are oval patches about ½ inch (1 centimeter) wide that extend about 2 inches (4 centimeters) along the intestine.

OBJECTIVE 17

Label the tonsils of the mouth and throat (see Figure 6).

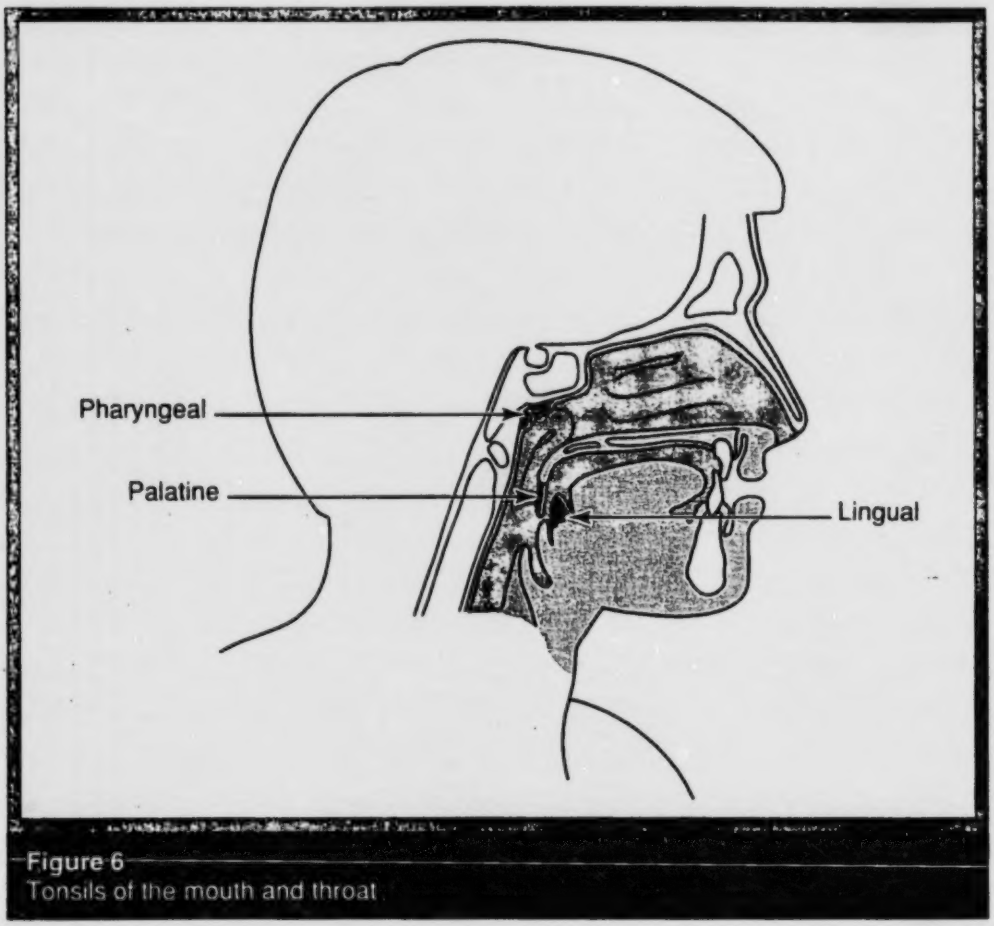


Figure 6
Tonsils of the mouth and throat

OBJECTIVE 18

Define common disorders and abnormalities of the lymphatic system.

1. **Splenomegaly** (sple-no-me´-guh-le)—An enlargement of the spleen that is associated with various conditions including infections and hypertension
2. **Lymphedema** (lim{p}f´-i-de-muh)—A disorder characterized by swelling and by the accumulation of lymph in soft tissue and caused by inflammation, obstruction, or removal of lymph channels
3. **Lymphangitis** (lim-fan´-je-tuhs)—An inflammation of one or more lymphatic vessels due to infection of one of the extremities
4. **Lymphoma** (lim-fo´-muh)—A tumor involving lymphatic tissue

   ✔ **NOTE:** One of the more-common forms of lymphoma is called *Hodgkin's disease*, a malignant disorder of unknown origin often first appearing in the cervical or axillary nodes. Most other lymphomas are referred to as *non-Hodgkin's lymphoma*. They are generally more widespread throughout the lymphatic system.
5. **Tonsillitis** (tawn-suh-li´-tuhs)—An infection of a tonsil

OBJECTIVE 19

Assignment Sheet 1—Practice Critical Thinking: Investigate the Involvement of the Lymphatic System in Interventions for Cancer

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

The lymphatic system is perhaps one of the most under appreciated of the body's systems. Its broad role of removing wastes and assisting in the immune response does not assert itself into daily living in the way the heart, brain, stomach, and other parts do. Except for occasional specific infections, such as strep throat or tonsillitis, the lymphatic system experiences few problems worthy of medical attention.

One of the functions of the lymphatic system that is often overlooked is its role in stopping the spread of cancer cells. Metastasis of cancer generally involves the bloodstream or the lymphatic system. Yet cancer cells are often trapped and destroyed in lymph nodes. An adjunct procedure associated with many cancer surgeries is the removal of lymph nodes that may harbor cancer cells. For example, the removal of a cancerous breast may be accompanied by the removal of lymph nodes. With the skin cancer melanoma, metastasis frequently involves one or more lymph nodes along the lymph drainage path of that body area. In this assignment sheet, you will examine the role of the lymphatic system in various types of cancer and the treatment procedures that may involve the lymphatic system.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Check with your instructor, who will assign you a type of cancer to research. Write the name of that cancer on the blank provided below.

_____ 3. Read the investigation points below and on the next page. Your investigative report must include answers to all six of these investigation points.

_____ 4. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided below.

_____ 5. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 6. Complete your investigation and give your investigative report to your instructor for evaluation.

Type of cancer to be investigated _____

Format of investigative report _____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

INVESTIGATION POINT 1

Describe how this type of cancer involves the lymphatic system.

INVESTIGATION POINT 2

Describe the diagnostic procedures used to determine the involvement of the lymphatic system.

INVESTIGATION POINT 3	Describe the types of medical interventions likely to be required if the lymphatic system is involved.
INVESTIGATION POINT 4	Lymph nodes are often referred to as *superficial* or *deep*, depending on their location relative to the surface of the skin. In the treatment for the cancer you are investigating, explain the considerations given depending on whether the involved lymph nodes are deep or superficial.
INVESTIGATION POINT 5	Describe the care required for the lymphatic system in the days immediately following normal surgical intervention.
INVESTIGATION POINT 6	Describe the long-term care required for the lymphatic system following normal surgical intervention.

MODULE SET II:
Major Body Systems

Module 11: Respiratory System

1286

Module Contents

Components		Page
	Learning Activities Sheet	3
	Module Objective Sheet	5
	Information Sheet	7
	Assignment Sheet	
	1—Practice Critical Thinking: Investigate Lung-Transplant Procedures	23

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 18.
- ❑ 5. **Research** Online resources to learn more about the respiratory system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Investigate Lung-Transplant Procedures."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

Module Objective

After completing this module, you should be able to describe and identify the major structures of the respiratory system, state the functions of the major structures of the respiratory system, and define common disorders and abnormalities of the respiratory system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

Specific Objectives

After completing this module, you should be able to

1. Define the term *respiratory system.*
2. Complete statements that describe the characteristics of pulmonary ventilation.
3. Define terms used to measure the various aspects of respiratory volume.
4. Complete statements that describe the portions of the thorax that are related to the lungs.
5. Define the major organs and structures of the respiratory system.
6. Label the major organs and structures of the respiratory system.
7. Complete statements that describe the characteristics and structures of the nose that are related to the respiratory system.
8. Complete statements that describe the characteristics of the pharynx that are related to the respiratory system.
9. Complete statements that describe the characteristics and structures of the larynx that are related to the respiratory system.
10. Complete statements that describe the characteristics and structures of the trachea.
11. Complete statements that describe the characteristics and structures of the bronchi.
12. Label the major structures of the bronchi.
13. Complete statements that describe the characteristics and structures of the lungs.
14. Label the major external structures of the lungs.
15. Complete statements that describe the characteristics and structures of the pleura.
16. Label the major structures of the pleura.
17. Complete statements that describe the muscles that change the size of the thorax.
18. Match common disorders and abnormalities of the respiratory system to their correct definitions.
19. Practice critical thinking: investigate lung-transplant procedures. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *respiratory system.*

- **Respiratory system**—The complex of organs and structures that performs the **pulmonary ventilation** of the body and **cellular respiration** (see Figure 1 below)

✔ **NOTE:** As you have studied previously, the cells undergo respiration. During the process of converting nutrients to energy, oxygen is required to fuel the chemical reaction and carbon dioxide is produced as a by-product of the reactions. You also know that the bloodstream carries the required oxygen to the cells and removes the carbon dioxide and other wastes. The source of oxygen is the air around us, which is approximately 21 percent oxygen at sea level. However, getting the oxygen out of the air and into the bloodstream is a specialized process performed by the respiratory system.

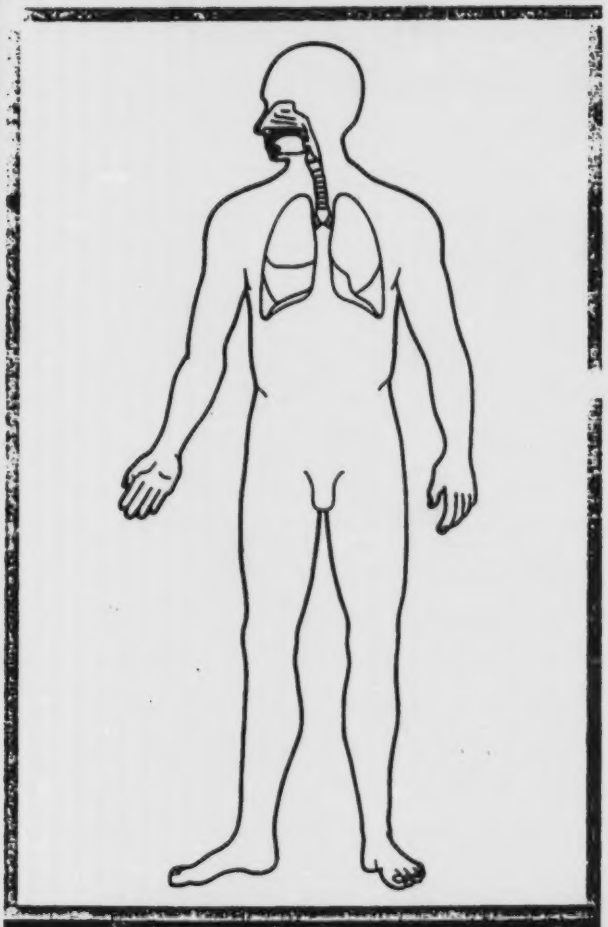


Figure 1
Respiratory system

KEY TERMS

Pulmonary ventilation—The process of inhaling and exhaling air through the lungs; breathing

✔ **NOTE:** Pulmonary ventilation is also called *external respiration.*

Cellular respiration—The process of oxygen carried by the blood passing into the cells and being used by the cells, which leads to the production of carbon dioxide that is then carried away by the blood

✔ **NOTE:** Cellular respiration is also called *internal respiration.*

OBJECTIVE 2

Complete statements that describe the characteristics of pulmonary ventilation.

✔ **NOTE:** Pulmonary ventilation (breathing) is a mechanical process. The lungs are alternately expanded by movement of the diaphragm, which creates low pressure in the lungs and allows air to be drawn in. To breathe out, the diaphragm relaxes, allowing the lungs to compress, thus forcing air out of the lungs.

1. **The mechanical portion of pulmonary ventilation (external respiration) is referred to as *breathing*.**

2. **There are two stages to breathing: inhalation and exhalation (inspiration and expiration).**

3. **Breathing is controlled by the medulla oblongata and the pons of the brainstem.**

   ✔ **NOTE:** Breathing can be consciously controlled by the central cortex. As we hold our breath or speak or shout, the volume of air exhaled is consciously regulated. However, if we try to hold our breath too long or speak too rapidly or too long, the medulla will force the respiratory system to breathe.

4. **The brain sends impulses down the spinal cord to the phrenic nerve and out to the diaphragm.**

5. **If the brainstem is severed in the cervical area or if the phrenic nerve is severed, respiration will cease.**

6. **The medulla is governed by variations in the chemistry of the blood that are detected by chemoreceptors in the carotid body and the aortic arch.**

KEY TERMS

Medulla oblongata (muh-duh´-luh aw-blon-gaw´-tuh)—One of the three parts of the brainstem that contains the cardiac, vasomotor, and the respiratory centers of the brain

Pons (pawnz´)—A broad mass of nerve fibers conspicuous on the ventral surface of the brainstem

Brainstem—The part of the brain composed of the **mesencephalon**, pons, and medulla oblongata and connecting the spinal cord with the forebrain and cerebrum

Mesencephalon (me-zen-se´-puh-lawn)—One of the three parts of the brainstem, lying just below the cerebrum and just above the pons

Phrenic (fren´-ik) **nerve**—The motor nerve to the diaphragm

Chemoreceptor (ke´-mo-ri-sep-tuhr)—A sensory nerve cell activated by chemical stimuli, such as a chemoreceptor in the carotid artery that is sensitive to a chemical in the blood that signals the respiratory center in the brain to increase or decrease respiration

Carotid body—A small structure containing neural tissue at the bifurcation of the carotid arteries

7. **The major regulator of respiration is the carbon-dioxide level in the blood; high concentrations of carbon dioxide increase the rate of respiration, while decreased concentrations of carbon dioxide slow the rate of respiration.**

8. **Normal pulmonary ventilation (external respiration) occurs at a rate of 14 to 20 times per minute.**

   ✔ **NOTE:** Breathing rates vary with a number of factors, both internal and external. The rate of breathing usually increases with exercise, during times of excitement, when the oxygen level is low (as in higher altitudes), and with different diseases.

OBJECTIVE 3 **Define terms used to measure the various aspects of respiratory volume.**

✔ **NOTE:** Breathing is a good indicator of many health factors. The rate of breathing, breath sounds, and several measurements of respiratory volume—the amount of air in the lungs—may indicate problems with the respiratory system.

1. **Tidal volume**—The amount of air involved in one respiration cycle, totaling approximately 1 pint (500 milliliters)

2. **Minute respiratory volume**—The amount of air inhaled and exhaled during a one-minute period, averaging approximately 6 quarts (6000 milliliters or 6 liters)

3. **Inspiratory volume**—The amount of air that can be taken in with the deepest possible inhalation beyond tidal volume, amounting to 2 to 3 quarts (2000 to 3000 milliliters)

4. **Expiratory volume**—The amount of air that can be expelled with the most-forceful exhalation possible beyond tidal volume, amounting to 1 to 1½ quarts (1000 to 1500 milliliters)

5. **Vital capacity**—The total respiration volume calculated as the sum of tidal volume, inspiratory volume, and expiratory volume, totaling 3½ to 5 quarts (3500 to 5000 milliliters)

6. **Residual air**—The amount of air that remains in the lungs after the most-forceful expiration, amounting to 1 to 1½ quarts (1000 to 1500 milliliters)

   ✔ **NOTE:** The lungs are never entirely emptied of air. Normally, the volume of air left in the lungs after an exhalation is a volume that provides equalized air pressure with the outside air. However, by using the intercostal muscles, additional air can be forced from the lungs. Even then, some air will remain.

OBJECTIVE 4 **Complete statements that describe the portions of the thorax that are related to the lungs.**

1. **The thorax** (thor-aks´), **which is also called the *chest*, is the part of the body between the neck and the abdomen; it is the cavity where the heart and lungs lie.**

2. **The pleural cavity is the cavity within the thorax that contains the lungs.**

3. **The mediastinum** (me-de-uh-sti´-nuhm) **is the space in the thorax between the two lungs** (see Figure 2 on page 11).

OBJECTIVE 5

Define the major organs and structures of the respiratory system (see Figure 2 on the next page).

✔ **NOTE:** The principal organs of the respiratory system are the lungs. However, a number of auxiliary structures are required to support respiration, including pathways to carry air to and from the lungs and muscles to pump the lungs.

1. **Nose**—The structure that protrudes from the anterior portion of the skull and serves as part of the passageway for air to and from the lungs

   ✔ **NOTE:** You will learn more about the nose as it relates to the respiratory system in Objective 7.

2. **Pharynx** (far´-in{k}s)—The throat; the muscular, tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for both the respiratory and digestive tracts

   ✔ **NOTE:** You will learn more about the pharynx as it relates to the respiratory system in Objective 8.

3. **Larynx** (lar´-in{k}s)—The organ of voice that is part of the air passageway connecting the pharynx with the trachea

   ✔ **NOTE:** You will study more about the larynx as it relates to the respiratory system in Objective 9.

4. **Trachea** (tra´-ke-uh)—The windpipe; the nearly cylindrical tube in the neck that extends from the lower end of the larynx to the point where it divides into the two bronchi of the lungs

   ✔ **NOTE:** You will learn more about the trachea in Objective 10.

5. **Bronchi** (brawn´-ke)—The large air passages in the lungs through which pass inspired air and exhaled waste gases

   ✔ **NOTE:** Each bronchus (brawn´-kus) has a wall consisting of three layers. The outermost layer is made of dense fibrous tissue reinforced with cartilage; the middle layer is a network of smooth muscle; the innermost layer consists of ciliated mucous membrane

   You will learn more about the bronchi in Objective 11 and Objective 12.

6. **Lungs**—The two light, spongy, highly elastic, **saccular** organs located in the thoracic cavity and constituting the main components of the respiratory system for inspiring air and exhaling carbon dioxide

   ✔ **NOTE:** You will study more about the lungs in Objective 13 and Objective 14.

KEY TERM

Saccular (sa´-kyuh-luhr)—Resembling a sac

7. **Pleura** (plur´-uh)—The delicate serous membrane that lines each half of the thorax and is folded over the surface of the lung on the same side

✔ **NOTE:** You will study more about the pleurae (plur´-e) in Objective 15 and Objective 16.

8. **Diaphragm** (di´-uh-fram)—The dome-shaped partition of muscle and connective tissue that separates the thoracic and the abdominal cavities and aids respiration by moving up and down

✔ **NOTE:** You will learn more about the diaphragm in Objective 17.

9. **Intercostal** (in´-tuhr-kaws-tuhl) **muscles**—The muscles between the ribs

✔ **NOTE:** You will study more about the intercostal muscles in Objective 17.

OBJECTIVE 6 **Label the major organs and structures of the respiratory system** (see Figure 2).

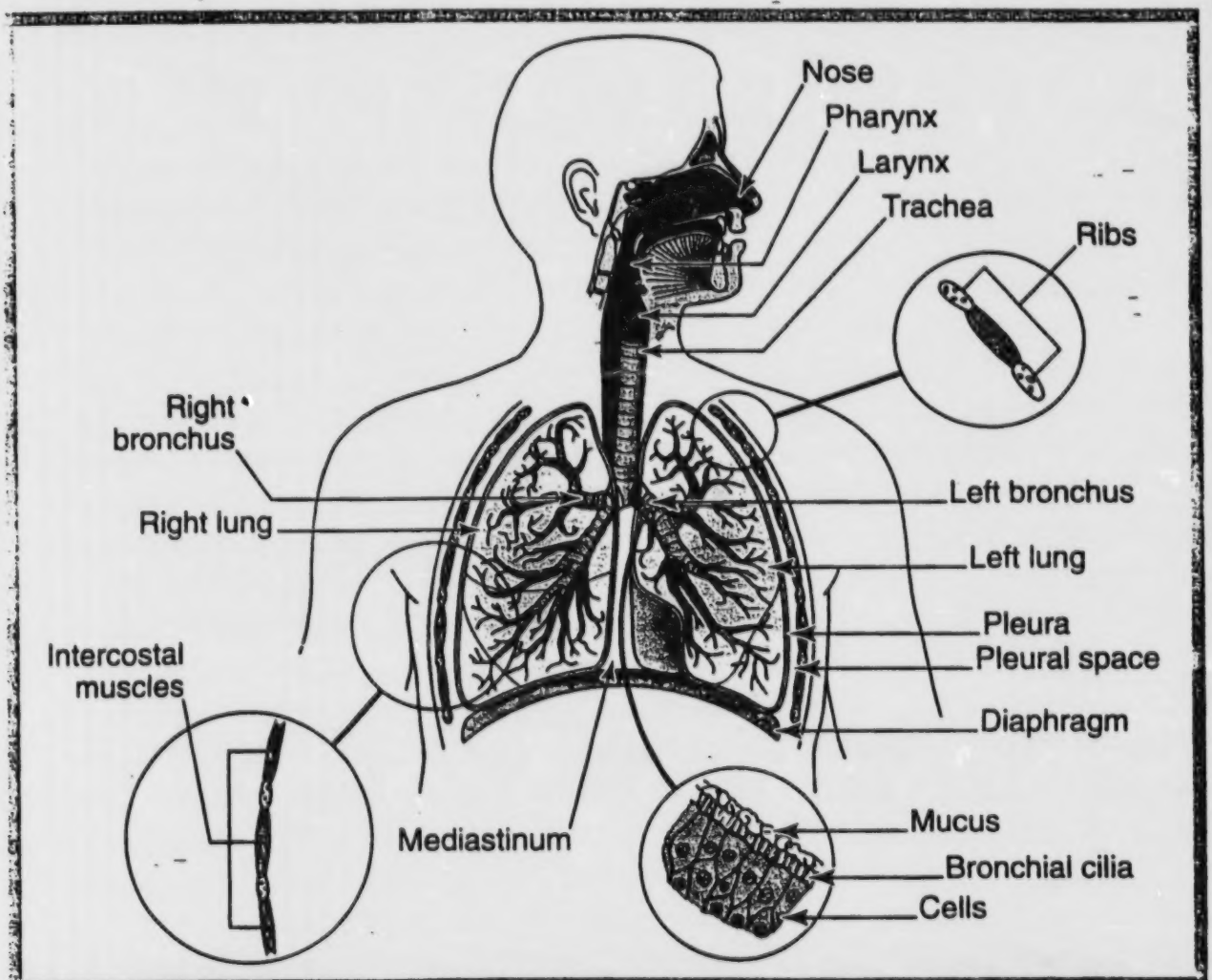


Figure 2
Major organs and structures of the respiratory system

OBJECTIVE 7

Complete statements that describe the characteristics and structures of the nose that are related to the respiratory system.

1. **The nose serves as a passageway for air going to the lungs.**
2. **The nose warms, moistens, and filters air passing into it.**
3. **The openings in the front of the nose are known as *nostrils* or *anterior nares*** (nar´-ez).
4. **The nose consists of two nasal cavities; the nasal cavities lie between the roof of the mouth and the cranium.**
5. **The nasal cavities are separated by a vertical partition known as the *nasal septum*.**
6. **The nasal cavities are constructed of bone covered by ciliated mucous membranes.**
7. **On the side walls of the nasal cavities are three projections known as *nasal conchae* or *turbinates* that greatly increase the surface area over which air must travel before reaching the lungs.**
8. **The mucous membranes of the nose are very vascular because they contain many blood vessels that bring warmth and moisture to these surfaces.**
9. **The nasal sinuses—the cavities in the various bones of the skull that are continuous with the nasal cavity—may also function to warm, moisten, and filter air before it enters the rest of the respiratory system, but the purpose of these cavities is not clear.**

KEY TERM

Concha (kawn´-kuh)—Something shaped like a shell

OBJECTIVE 8

Complete statements that describe the characteristics of the pharynx that are related to the respiratory system.

1. **The pharynx is about 5 inches (12.5 centimeters) long and is composed of muscle lined with mucous membrane.**
2. **The pharynx passes air from the nasal cavities to the larynx.**
3. **The pharynx consists of three divisions: the nasopharynx, the oropharynx, and the laryngopharynx.**
4. **The nasopharynx is the upper portion of the pharynx that lies behind the nose and above the palate.**

5. **The oropharynx is the middle portion of the pharynx that lies behind the mouth and between the palate and the hyoid bone.**

KEY TERM

Hyoid (hi´-oid) **bone**—The U-shaped bone situated at the base of the tongue and supporting the tongue and its muscles

6. **The laryngopharynx is the lower portion of the pharynx that lies immediately below the hyoid bone and above the larynx.**

OBJECTIVE 9

Complete statements that describe the characteristics and structures of the larynx that are related to the respiratory system.

1. **The larynx is shaped like a triangular box with flat sides and a prominent ridge in front.**
2. **The larynx consists of nine pieces of cartilage that are connected by ligaments and are moved by various muscles.**
3. **The three prominent cartilages of the larynx are the thyroid cartilage, the epiglottis** (e-puh-glaw´-tuhs)**, and the cricoid** (kri´-koid) **cartilage.**
4. **The thyroid cartilage is the largest and is commonly called the *Adam's apple;* this cartilage is usually larger in men than in women.**
5. **The epiglottis covers the entrance into the larynx during swallowing, thus preventing food or liquids from entering the airway.**
6. **The cricoid cartilage is the lowest of the cartilage structures and has the appearance of a signet ring.**

OBJECTIVE 10

Complete statements that describe the characteristics and structures of the trachea.

1. **The trachea is about 4½ inches (11 centimeters) long and about 1 inch (2.5 centimeters) from side to side.**
2. **The trachea is a tube of smooth muscle lined with mucous membrane.**
3. **The muscle tissue is strengthened and held open by 16 to 20 C-shaped rings of hyaline cartilage, each with the open portion of the C toward the posterior near the esophagus.**

KEY TERM

Hyaline (hi´-uh-luhn) **cartilage**—The translucent, bluish-white cartilage present in the joints and in the respiratory passages

OBJECTIVE 11

Complete statements that describe the characteristics and structures of the bronchi.

1. **The bronchi consist of two primary bronchi: the right bronchus and the left bronchus** (see Figure 2 on page 11 and Figure 3 on the next page).

2. **The right bronchus is shorter and more vertical than the left bronchus.**

3. **The structure of the bronchi resembles the trachea as the walls contain cartilage rings and ciliated mucous lining.**

4. **Each bronchus enters the lung at the notch or depression on the medial surface called the *hilus*** (hi´-lus) **or *hilum*** (hi´-luhm).

5. **Each primary bronchus enters the lung on its respective side and immediately subdivides into smaller branches called *secondary bronchi*.**

6. **Secondary bronchi continue to branch, forming small bronchioles, which lack cartilage** (see Figure 3 on the next page).

7. **The bronchioles subdivide into smaller and smaller tubes, eventually ending in microscopic branches that divide into alveolar ducts, ending in several alveolar sacs that consist of numerous alveoli** (see Figure 3 on the next page).

8. **Alveolar ducts and sacs look like a cluster of grapes with the stem as the alveolar duct, each cluster as an alveolar sac, and each grape as an alveolus** (see Figure 3 on the next page).

9. **The alveoli are enveloped by networks of capillaries that provide spaces where gaseous exchange between the air and the blood can occur** (see Figure 3 on the next page).

✔ **NOTE:** The trachea, the two primary bronchi, and their primary branches resemble an inverted tree and are referred to as the *bronchi tree* or *bronchial tree*. By the time the branches of the bronchial tree have dwindled to form alveoli, only the internal surface layer of cells remains.

OBJECTIVE 12 **Label the major structures of the bronchi** (see Figure 3).

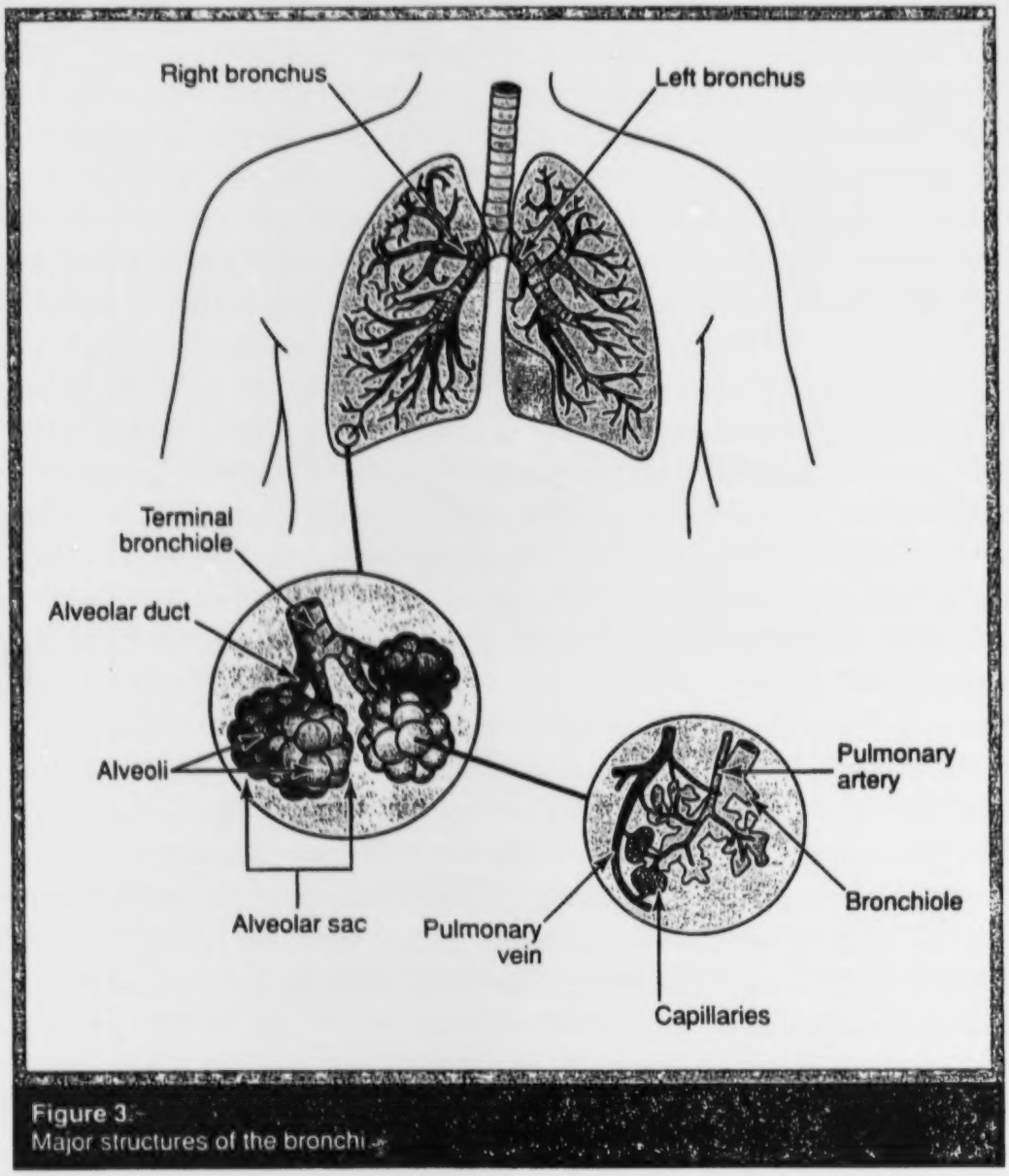


Figure 3
Major structures of the bronchi

OBJECTIVE 13

Complete statements that describe the characteristics and structures of the lungs.

1. **The two lungs rest side by side and extend from the diaphragm to a point slightly above the clavicles and lie against the ribs at the anterior and posterior** (see Figure 2 on page 11).

2. **The medial surface of each lung is concave to allow room for the mediastinal structures and the heart** (see Figure 4 on the next page).

3. **The lung root attaches to the mediastinum** (see Figure 2 on page 11) **and is composed of all the structures entering and leaving the lung, including the primary bronchi, the pulmonary arteries and veins, the bronchial arteries and veins, the lymph vessels and nodes, and the nerves.**

KEY TERMS

Medial (me´-de-uhl)—Oriented toward the midline; being or occurring in the middle

Mediastinal (me-de-uh-sti´-nuhl)—Related to the mediastinum

4. **The apex of a lung is the pointed upper margin that extends slightly above the clavicle** (see Figure 2 on page 11 and Figure 4 on the next page).

5. **The base of a lung is the broad, inferior surface that lies on the diaphragm** (see Figure 2 on page 11 and Figure 4 on the next page).

6. **The left lung has an indentation for the heart called the *cardiac notch* (cardiac depression)** (see Figure 4 on the next page).

7. **The right lung is slightly larger, heavier, and shorter (by about 1 inch [2.5 centimeters]) than the left lung.**

8. **The right lung is divided into three lobes: the upper lobe, the middle lobe, and the lower lobe** (see Figure 4 on the next page).

9. **The left lung is divided into two lobes: the upper lobe and the lower lobe** (see Figure 4 on the next page).

10. **At birth, a person's lungs are pink, but with age they become a mottled-gray color due to the inhalation of dust, pollution, and smoke.**

11. **When filled to capacity, a lung can hold approximately 275 cubic inches (4500 cubic centimeters) of air, though only 30 cubic inches (500 cubic centimeters) are inhaled and exhaled in a normal breath.**

12. **The lungs act as an excretory organ in that a person loses about 24 cubic inches (400 cubic centimeters) of moisture per day in expired air.**

Objective 14 **Label the major external structures of the lungs** (see Figure 4).

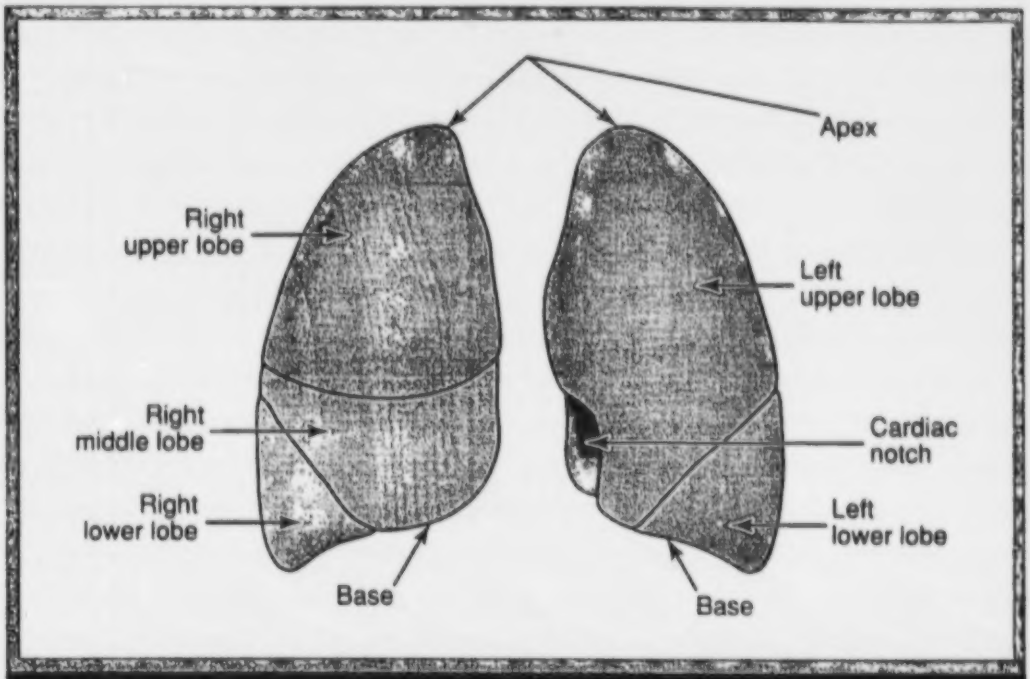


Figure 4
Major external structures of the lungs

Objective 15 **Complete statements that describe the characteristics and structures of the pleura.**

1. **The pleura divides into the visceral pleura and the parietal pleura** (see Figure 5 on the next page).
2. **The visceral pleura covers the lung and dips into the fissures between the lobes.**
3. **The parietal pleura lines the chest wall, covers the diaphragm, and reflects over the structures in the mediastinum.**
4. **The parietal and visceral pleurae are separated from each other by a small amount of fluid—pleural fluid—that acts as a lubricant as the lungs expand and contract during respiration** (see Figure 5 on the next page).
5. **Pleural fluid is secreted by the serous membrane.**
6. **Excess secretion of pleural fluid results in pleural effusion.**

Key Term

Pleural effusion (plur´-uhl i-fyu´-zhuhn)—The collection of pleural fluid in the pleural space

OBJECTIVE 16

Label the major structures of the pleura (see Figure 5).

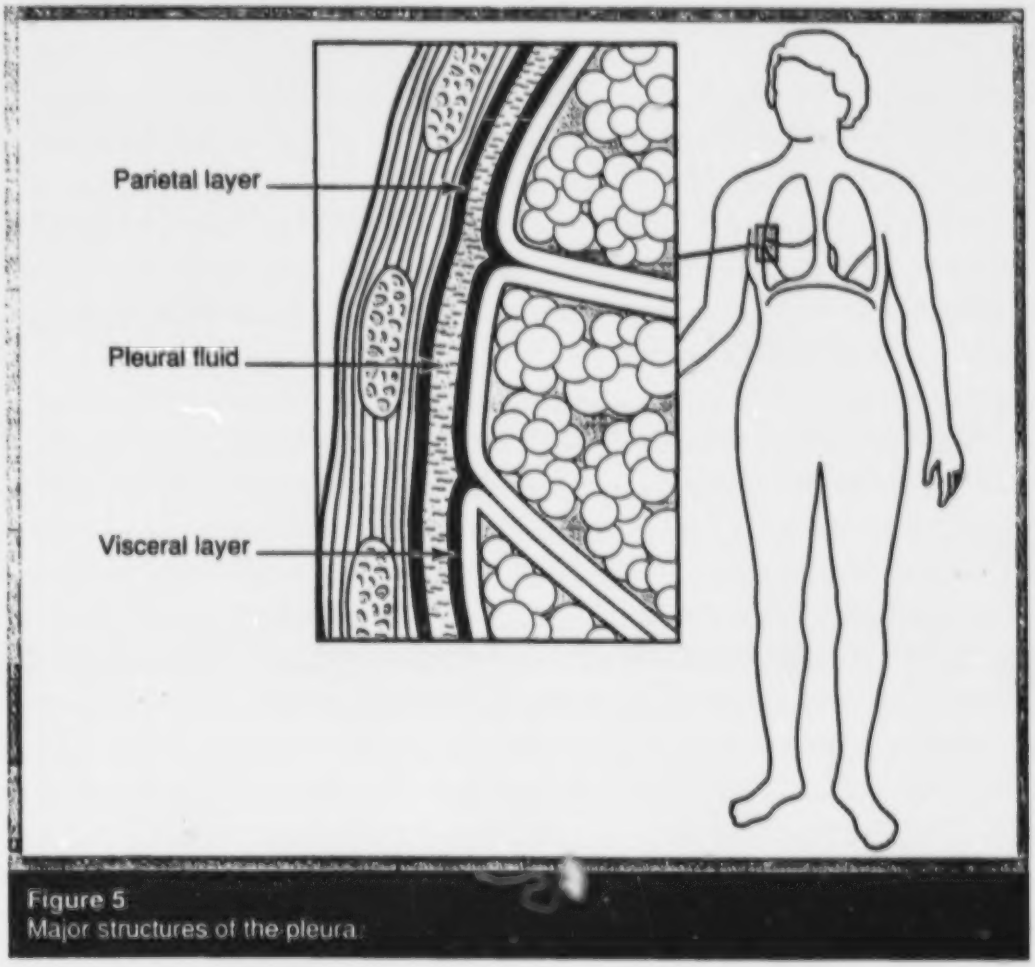


Figure 5
Major structures of the pleura

OBJECTIVE 17

Complete statements that describe the muscles that change the size of the thorax.

1. **The diaphragm is the primary muscle of breathing.**
2. **On inspiration, the diaphragm contracts, flattens, and moves downward to enlarge the thoracic cavity.**
3. **On expiration, the diaphragm relaxes and moves upward to decrease the size of the thoracic cavity.**
4. **The intercostal muscles (intercostals) are the secondary muscles of breathing.**
5. **The intercostal muscles are designated as external and internal.**
6. **The external intercostals elevate the ribs.**
7. **The internal intercostals depress the ribs.**

OBJECTIVE 18

Match common disorders and abnormalities of the respiratory system to their correct definitions.

✔ **NOTE:** The respiratory system is subject to many conditions that differ from normal functioning. This is partially because the passages of the respiratory system are portals of entry for pathogens, toxins, and objects.

1. **Dyspnea** (dis(p)´-ne-uh)—Painful, difficult, and labored respiration

   ✔ **NOTE:** Normal respiration is referred to as *eupnea* (yup-ne´-uh).

2. **Hypernea** (hi-puhr´-ne-uh)—An increased rate of respiration, often with deep inspirations

3. **Apnea** (ap´-ne-uh)—The transient cessation of breathing

4. **Anoxia** (a-nawk´-se-uh)—An abnormal condition characterized by a lack of oxygen

   ✔ **NOTE:** Anoxia may be local or systemic and may be the result of an inadequate supply of oxygen to the respiratory system or of the inability of the blood to carry oxygen to the tissues.

5. **Hypoxia** (hi-pawk´-se-uh)—The condition resulting from inadequate oxygen reaching the cells

6. **Suffocation** (suh-fuh-ka´-shuhn)—An interruption in breathing with oxygen deprivation usually caused by an obstruction in the airways

   ✔ **NOTE:** Suffocation may be accidental, intentional, or the result of a disease or of inadequate levels of respirable gases in the atmosphere.

7. **Asphyxia** (as-fik´-se-uh)—A condition of increased carbon dioxide and decreased oxygen in the body as a result of diminished respiration

   ✔ **NOTE:** Some of the more-common causes of asphyxia are drowning, electric shock, foreign objects in the respiratory tract, inhalation of toxic gas or smoke, and poisoning.

8. **Cheyne-Stokes** (shayn´ stoks´) **respiration** (CSR)—An abnormal pattern of respiration characterized by alternating periods of apnea and deep, rapid breathing

   ✔ **NOTE:** The respiratory cycle in CSR begins with slow, shallow breaths that gradually increase to abnormal depth and rapidity. Respiration gradually subsides as breathing slows and becomes shallower. Severe head injury, congestive heart failure, bronchopneumonia, or other respiratory diseases may induce CSR.

9. **Cyanosis** (si-uh-no´-suhs)—The condition characterized by bluish-gray discoloration of the skin and mucous membranes as a result of insufficient oxygen

10. **Deviated nasal septum** (de´-ve-at-uhd na´-zuhl sep´-tuhm)—A shift in the partition of the nasal cavity

✔ **NOTE:** The nasal septum commonly shifts to the left during normal growth, but the condition is often aggravated by a blow to the nose or other trauma. A severely deviated septum may result in obstruction of the nasal passages, leading to infection, sinusitis, shortness of breath, headache, and nosebleeds.

11. **Asthma** (az´-muh)—A respiratory disorder characterized by constriction of the bronchioles, excessive production of mucus, and difficult breathing

✔ **NOTE:** Episodes of asthma are characterized by wheezing on expiration and inspiration and coughing. The episodes may be triggered by inhalation of allergens or pollutants, infection, cold air, vigorous exercise, or emotional stress.

12. **Emphysema** (em{p}-fuh-ze´-muh)—The deterioration of alveoli and reduced elasticity of the lungs, leading to impairment of normal gas exchange

✔ **NOTE:** When emphysema occurs early in life, it is usually the result of a rare genetic deficiency. Acute emphysema may be caused by bronchopneumonia, suffocation, and whooping cough. Chronic emphysema usually accompanies chronic bronchitis, a major cause of which is cigarette smoking.

13. **Hyaline** (hi´-uh-luhn) **membrane disease**—A condition in premature infants whose lungs have not developed enough to allow inflation of the alveoli

✔ **NOTE:** Hyaline membrane disease is also called *respiratory distress syndrome of the newborn* (RDS).

14. **Laryngeal** (luh-rin´-je-uhl) **edema**—A condition in which fluid accumulates around the vocal cords

✔ **NOTE:** The condition is also called *edema of the glottis*, which is usually inflammatory and may result from an infection, injury, or inhalation of toxic gases.

15. **Pulmonary edema**—A condition in which fluid accumulates in lung tissues and in the alveoli

✔ **NOTE:** Pulmonary edema is caused most commonly by congestive heart failure but also occurs in barbiturate and opiate poisoning, infections, renal failure, and after a stroke, skull fracture, near drowning, and inhalation of irritating gases.

16. **Pneumonia** (nu-mo´-nyuh)—An acute inflammation of the lungs usually caused by a bacterial infection

✔ **NOTE:** Pneumonia may also be caused by viruses, rickettsiae, or fungi.

17. **Pneumothorax** (nu-muh-thor´-aks)—A collection of air or gas in the pleural space causing the lung to collapse

✔ **NOTE:** Pneumothorax may be the result of an open chest wound that permits the entrance of air, a rupture on the surface of a lung, or a severe bout of coughing.

18. **Respiratory distress**—Any of various conditions in which the mechanics of respiration fail to inflate the alveoli

19. **Upper respiratory infection**—An infection of the mucosa of the nose, pharynx, or larynx

20. **Rhinitis** (ri-ni´-tuhs)—An inflammation of the mucous membranes of the nasal cavities generally accompanied by swelling of the mucosa and a nasal discharge

    ✔ **NOTE:** Rhinitis may be acute, allergic, atrophic, or vasomotor, and it may also be called *coryza* (kuh-ri´-zuh).

21. **Pharyngitis** (far-uhn-ji´-tuhs)—An inflammation or infection of the pharynx, usually causing symptoms of a sore throat

22. **Laryngitis** (lar-uhn-ji´-tuhs)—An inflammation or infection of the larynx, usually accompanied by edema of the vocal cords with hoarseness or loss of the voice

23. **Bronchitis** (brawn-ki´-tuhs)—An acute or chronic inflammation of the bronchial tree, often as a result of infection

24. **Tuberculosis** (tu-buhr-kyuh-lo´-suhs) (TB)—A chronic, highly contagious infection of the lungs from the bacillus *Mycobacterium tuberculosis*

25. **Lung cancer**—A malignancy seated in the pulmonary tissue, generally affecting lungs damaged by disease, pollutants, or smoking

OBJECTIVE 19

Assignment Sheet 1—Practice Critical Thinking: Investigate Lung-Transplant Procedures

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

As a surgical technician, you may become involved in a number of procedures that involve the lungs—directly or indirectly. Surgery to correct disorders of the airway and lungs due to injury, cancer, tuberculosis and other diseases are fairly common and often critical. Complications of other types of surgical procedures often involve the lungs, including various forms of pneumonia. Consequently, surgical technicians need to be familiar with the surgical procedures that address the respiratory system.

The web sites listed below provide information about lung transplants. This procedure involves the removal of a lung from a deceased donor and its surgical implant in a recipient. The procedure may be required to replace a lung that has been damaged by disease or injury. These web sites and others that your instructor may provide you offer lots of useful information about the procedure.

- *http://www.chestsurg.org/
- http://cpmcnet.columbia.edu/dept/pulmonary/lungtx.html
- http://www.med.jhu.edu/transplant/overviews/lung_program.html
- http://www.mamc.amedd.army.mil/williams/CHEST/Misc/Transplant/Transplant.htm

You will review the web sites above and other resources to determine information related to lung transplants.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Read the investigation points below and on the next page. Your investigative report must include answers to all of these investigation points.

_____ 3. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided below.

_____ 4. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 5. Complete your investigation and give your investigative report to your instructor for evaluation.

Format of investigative report _____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

INVESTIGATION POINT 1

List and explain some of the reasons a person might be a candidate for a lung transplant.

INVESTIGATION POINT 2

Describe some of the evaluations that may be made on a patient who may be a candidate for a lung transplant.

INVESTIGATION POINT 3

The web sites listed in the introduction to this assignment discuss a number of factors related to the rejection of a transplanted heart. Briefly explain the general cause of rejection and state what can be done to overcome it. Also, assess the potential for rejection in general and as related to specific conditions that may require lung transplants.

INVESTIGATION POINT 4

In some cases the transplant procedure will not be successful due to other complications, such as infections, damage to the transplanted organ, and similar factors. Choose one of the complications presented in the resource web sites or one assigned by your instructor. Discuss the nature of the complication, its likelihood of occurrence, factors that may promote or prevent its occurrence, and treatment for the complication.

INVESTIGATION POINT 5

Based on the information that you have studied in the available resources, what recommendations should be made to a 58-year-old male smoker with emphysema in both lungs but who is otherwise healthy? Is a lung transplant in order? Why or why not?

MODULE SET II:
Major Body Systems

Module 12: Digestive System

1309

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Investigate Surgical Requirements for the Digestive System	35

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 30.
- ❑ 5. **Research** Online resources to learn more about the digestive system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Investigate Surgical Requirements for the Digestive System."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** With your instructor for any additional assignments to be completed.

❑ 11.	Do	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	Take	Module Review provided by your instructor.
❑ 13.	Stop	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	Stop	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the digestive system and define common disorders and abnormalities of the digestive system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *digestive system.*
2. State the functions of the digestive system.
3. Define the term *alimentary tract.*
4. Define the organs and structures of the alimentary tract.
5. Define the term *accessory glands.*
6. Define the accessory glands of the digestive system.
7. Label the major organs and structures of the digestive system.
8. Complete statements that describe the characteristics and structures of the mouth.
9. Label the major structures of the mouth.
10. Complete statements that describe the characteristics and structures of the teeth.
11. Label the major structures of a tooth.
12. Define the types of teeth as classified by location and function.
13. Label the types of teeth as classified by location and function.
14. Complete statements that describe the characteristics and structures of the pharynx that relate to the digestive system.
15. Complete statements that describe the characteristics and structures of the esophagus.
16. Define the major structures of the stomach.
17. Label the major structures of the stomach.
18. Complete statements that describe the characteristics and functions of the stomach.
19. Define the major structures of the small intestine.

20. Complete statements that describe the characteristics and functions of the small intestine.
21. Define the major structures of the large intestine.
22. Define the sections and flexures of the colon.
23. Label the major structures of the large intestine.
24. Complete statements that describe the characteristics and functions of the large intestine.
25. Complete statements that describe the characteristics and structures of the liver.
26. List the functions of the liver.
27. Complete statements that describe the characteristics and structures of the pancreas.
28. Complete statements that describe the characteristics and structures of the gallbladder.
29. Label the major structures of the liver, pancreas, and gallbladder.
30. Match common disorders and abnormalities of the alimentary tract to their correct definitions.
31. Practice critical thinking: investigate surgical requirements for the digestive system. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *digestive system*.

- **Digestive system**—The organs, structures, and accessory glands of the digestive tube of the body through which food passes from the mouth to the **anus** (see Figure 1 below)

KEY TERM

Anus (a´-nus)—The posterior opening of the alimentary tract

✔ **NOTE:** See Objective 3 for the definition of the term *alimentary tract*.

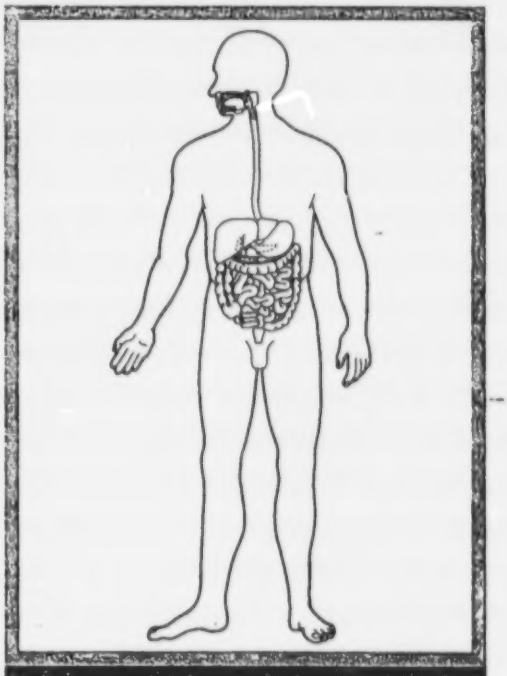


Figure 1
Digestive system

OBJECTIVE 2

State the functions of the digestive system.

1. **To convert the complex organic-compound molecules of ingested food into simple organic and inorganic compounds that are capable of being transported by the circulatory and lymphatic systems and being used by cells to produce energy**

✔ **NOTE:** As you have studied previously, the basic processes that support life center around the production of energy at the cell level. This involves simple chemical reactions in which substances enter the cells and are broken down into their component molecules, releasing energy that the cell can use to carry out its work. Obviously, only very small bits of these materials are able to enter a cell. Because the source of these materials is the food we eat, something must be done to break down the food so that the required chemicals can be transported to the cells. This is a major function of the digestive system.

2. **To convert nutrients into energy at the cellular level**

✔ **NOTE:** Only a portion of the food that we consume is usable by the body in carrying out its conversion of chemicals into energy. The general term for these materials is *nutrients* (nu´-tre-uhnts). Nutrients are classified in various ways based on their chemical composition and the ways in which they are used by the body. **Carbohydrates**, or sugars, are the major source of energy. **Lipids**, commonly referred to as *fats*, can be used as a source of energy and in some form is the method of storing energy in the body. **Proteins** can also be used for energy but are more commonly the source of many of the enzymes that the body uses to carry out chemical reactions. **Vitamins** and **minerals** are also required to support many of the body's chemical reactions. These substances are delivered to the cells through digestion.

KEY TERMS

Organic (or-ga´-nik)—Related to those chemicals that contain carbon and are commonly found as the building blocks of living things

✔ **NOTE:** Chemicals can generally be classed as organic or inorganic. All organic chemicals contain carbon and generally oxygen and hydrogen. They are formed as part of the life processes of plants and animals. All other chemicals are referred to as *inorganic*.

Carbohydrate (kawr-bo-hi´-drat)—Any of various compounds that include carbon, hydrogen, and oxygen, including sugars, starches, and cellulose, most of which are produced by green plants

Lipid (li´-puhd)—A family of organic compounds that include true fats, phospholipids, and steroids such as cholesterol

Protein (pro´-ten)—Any of various organic compounds that contain carbon, oxygen, hydrogen, and nitrogen that are synthesized from raw materials by plants and used as amino acids by animals

✔ **NOTE:** Amino (uh-me´-no) acids are the building blocks of proteins. Many amino acids in the body are derived from breaking down proteins and are used by the body as enzymes and catalysts in chemical reactions.

Vitamin (vi´-tuh-muhn)—Any of various organic substances that are essential to promote bodily processes but which in themselves do not supply energy or serve as building blocks for the body

Mineral (mi´-nuh-ruhl)—Any of various inorganic substances including metals (iron, zinc), salts, water, and most normally solid inorganic chemicals

3. **To convert excess nutrients into fat for later use**

✔ **NOTE:** If a person eats a greater supply of energy-producing substances than the body needs to carry out its functions, the body will store part of that energy as fat. The amount of energy that the body can obtain through chemical reactions may be thought of as heat and, thus, the amount of energy in food is measured in the unit of measures commonly used to measure heat energy—**calories**. Therefore, if a person consumes more calories than the body uses, an increase in body fat—stored energy—is likely.

4. **To eliminate from the body the by-products of digestion that are not used by the cells or stored**

✔ **NOTE:** A portion of the food we eat is not usable by the body. For example, the structural component of many vegetables is a substance called *cellulose* (sel´-yuh-los). The body cannot digest cellulose and eliminates it with other waste products through **defecation** and **urination**.

KEY TERMS

Calorie (ka´-luh-re)—The amount of heat required to raise the temperature of a kilogram of water one degree Celsius at normal atmospheric pressure at sea level; also the amount of energy-producing potential in food equal to 1 calorie of heat

✔ **NOTE:** Food calories are sometimes referred to as *kilogram calories* or simply *kilocalories* because the unit of measure applies to a kilogram of water as opposed to a gram calorie, which is one-thousandth of a kilogram calorie or large calorie.

Defecation (de-fi-ka´-shuhn)—The act of discharging body wastes through the anus

✔ **NOTE:** Defecated wastes consist primarily of cellulose and water and are referred to as *feces* (fe´-sez).

Urination (yur-uh-na´-shuhn)—The process of eliminating chiefly fluid wastes from the body, including dissolved proteins, vitamins, and salts and other minerals

OBJECTIVE 3 **Define the term *alimentary tract.***

■ **Alimentary tract**—The digestive tube; the muscular tube that extends from the mouth to the anus (see Figure 2 on page 12)

✔ **NOTE:** The alimentary tract is also called the *digestive tract, gastrointestinal* (GI) *tract, alimentary canal, intestinal tract,* and *intestinal tube.*

OBJECTIVE 4

Define the organs and structures of the alimentary tract (see Figure 2 on page 12).

1. **Mouth**—The nearly oval oral cavity at the anterior end of the alimentary tract

   ✔ **NOTE:** You will learn more about the mouth in Objective 8 through Objective 13.

2. **Pharynx**—The throat; the tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for the respiratory and alimentary tracts

   ✔ **NOTE:** The pharynx divides into two tubes: one that leads to the lungs (the trachea) and one that leads to the stomach (the esophagus). You will study more about the pharynx in Objective 14.

3. **Esophagus**—The muscular canal that extends from the pharynx to the stomach and is the narrowest part of the alimentary tract

   ✔ **NOTE:** You will study more about the esophagus in Objective 15.

4. **Stomach**—The major organ of digestion that receives partially processed food and drink funneled from the esophagus and then moves nutritional bulk into the small intestine

   ✔ **NOTE:** You will study more about the stomach in Objective 16 through Objective 18.

5. **Small intestine**—The longest portion of the alimentary tract that extends from the stomach to the large intestine; the portion of the alimentary tract where digestion is completed and the end products of digestion are absorbed into the blood and lymph

   ✔ **NOTE:** The small intestine may also be called the *small bowel*. You will study more about the small intestine in Objective 19 and Objective 20.

6. **Large intestine**—The portion of the alimentary tract that extends from the small intestine to the anus

   ✔ **NOTE:** The large intestine is sometimes called the *large bowel*. You will study more about the large intestine in Objective 21 through Objective 24.

OBJECTIVE 5

Define the term *accessory glands*.

- **Accessory glands**—The glands of the digestive system that secrete the digestive enzymes that are used by the digestive system to break down food substances in preparation for absorption into the bloodstream before carrying the waste to the intestines for excretion

OBJECTIVE 6

Define the accessory glands of the digestive system (see Figure 2 on the next page).

1. **Liver**—The largest gland of the body, weighing approximately 3 to 4 pounds (7.2 to 10 kilograms), shaped like an irregular hemisphere, and located beneath the diaphragm in the right upper quadrant of the abdominal cavity

   ✔ **NOTE:** The liver is a complex gland that performs many functions. You will study more about the liver in Objective 25, Objective 26, and Objective 29.

2. **Pancreas**—The fish-shaped gland that lies posterior and slightly inferior to the stomach and secretes various substances, such as digestive enzymes, insulin, and glucagon

   ✔ **NOTE:** You will study more about the pancreas in Objective 27 and Objective 29.

3. **Gallbladder**—The pear-shaped gland located on the surface of the liver and serving as a reservoir for bile

   ✔ **NOTE:** You will study more about the gallbladder in Objective 28 and Objective 29.

KEY TERM

Bile (bil′)—The bitter, yellow-green secretion of the liver that is stored in the gallbladder and passes from the gallbladder in response to the presence of a fatty meal in the stomach

OBJECTIVE 7

Label the major organs and structures of the digestive system (see Figure 2 on the next page).

✔ **NOTE:** The organs of the alimentary tract support the intake of food, its mechanical and chemical digestion, and the elimination of wastes. Digestion includes those processes that prepare the nutrients for use by the body (including storage of excess nutrients) or elimination as wastes. Mechanical digestion includes the physical breakdown of food through chewing and swallowing, while chemical breakdown begins with the saliva and continues as enzymes and other chemicals cause ingested materials to separate into its constituent parts.

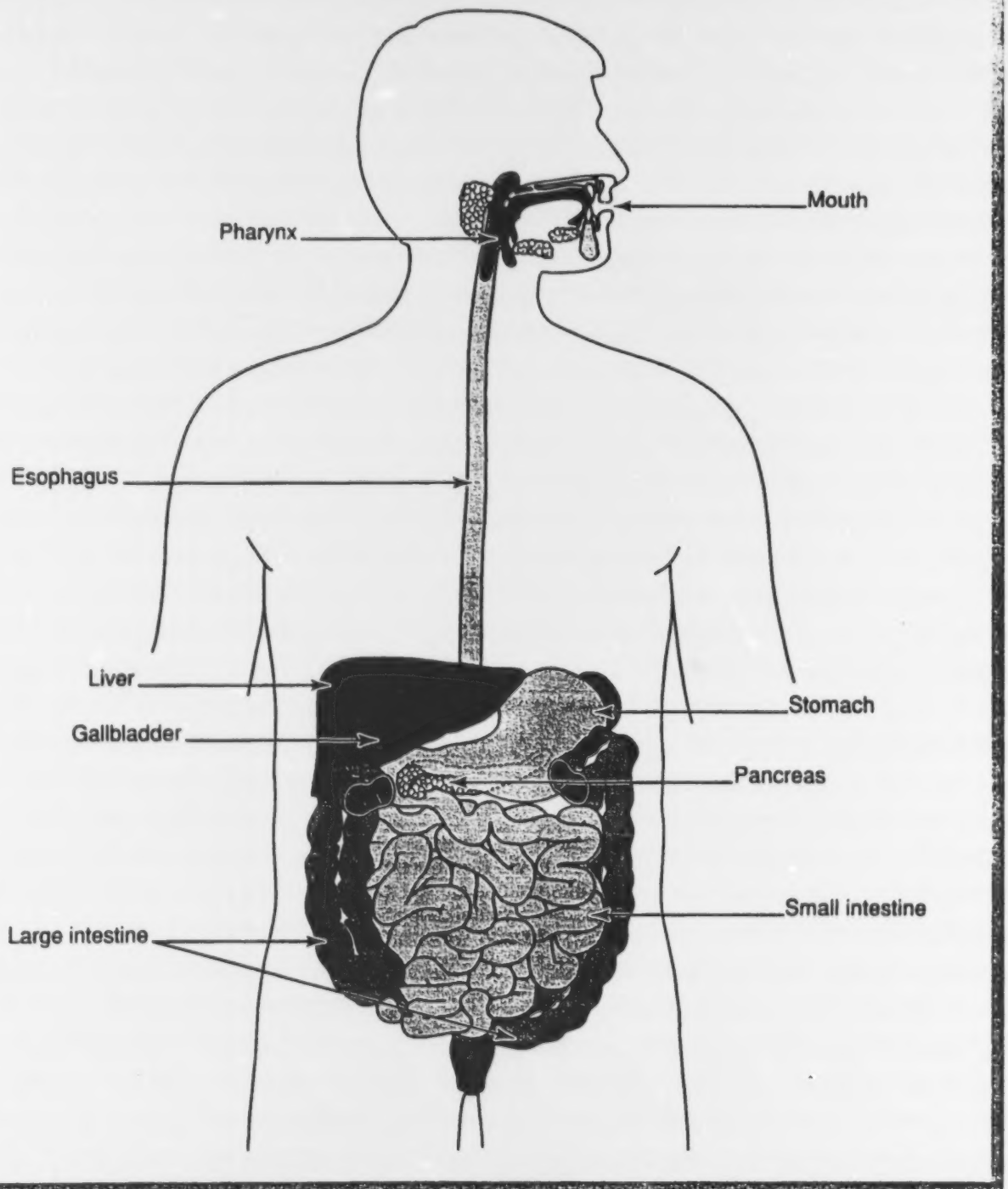


Figure 2
Major organs and structures of the digestive system

OBJECTIVE 8

Complete statements that describe the characteristics and structures of the mouth.

1. **The mouth is the oral cavity enclosed by the cheeks and lips** (see Figure 2 on page 12 and Figure 3 on the next page).

   ✔ **NOTE:** The cheeks are also called the *bucca* (buh´-kuh), and the mouth or oral cavity is also called the *buccal* (buh´-kuhl) *cavity*.

2. **The major structures of the mouth (oral cavity) are the tongue, the hard palate, the soft palate, the teeth, and the salivary glands** (see Figure 3 on the next page).

3. **The tongue forms most of the floor of the mouth** (see Figure 3 on the next page) **and assists in mastication and deglutition of food.**

KEY TERMS

Mastication (mas-tuh-ka´-shuhn)—Grinding or crushing food with the teeth

Deglutition (de-glu-ti´-shuhn)—The process of swallowing

4. **The hard palate and the soft palate are the two structures that form the roof of the mouth** (see Figure 3 on the next page).

5. **The hard palate is the structure composed of bone that forms the anterior part of the roof of the mouth; the soft palate is the structure that is composed of mucous membrane, muscular fibers, and mucous glands suspended from the posterior border of the hard palate** (see Figure 3 on the next page).

6. **When the soft palate rises in swallowing, it separates the nasal cavity and the nasopharynx from the posterior part of the mouth (oral cavity) and the oral portion of the pharynx.**

7. **The uvula** (yu´-vyuh-luh) **is the conical structure that hangs from the posterior border of the soft palate** (see Figure 3 on the next page).

8. **The teeth are the hard, bony structures on the bones of the mouth** (see Figure 3 on the next page) **that mechanically break down food into smaller pieces during mastication.**

   ✔ **NOTE:** You will study more about the types and structure of the teeth in Objective 10 through Objective 13.

9. **The mouth (oral cavity) contains salivary glands that secrete saliva; saliva contains enzymes that begin breaking down food chemically.**

10. **There are three pair of salivary glands: the parotid, the submandibular, and the sublingual** (see Figure 3 on the next page).

11. **The parotid glands are the largest of the salivary glands; they are located under and in front of each ear and secrete clear, watery serous fluid and an enzyme called *amylase*** (a´-muh-las).

12. **The submandibular salivary glands are located in the posterior portion of the floor of the mouth and secrete serous fluid with some mucus.**

13. **The sublingual salivary glands are located in the anterior portion of the floor of the mouth and secrete thick mucus.**

OBJECTIVE 9 **Label the major structures of the mouth** (see Figure 3).

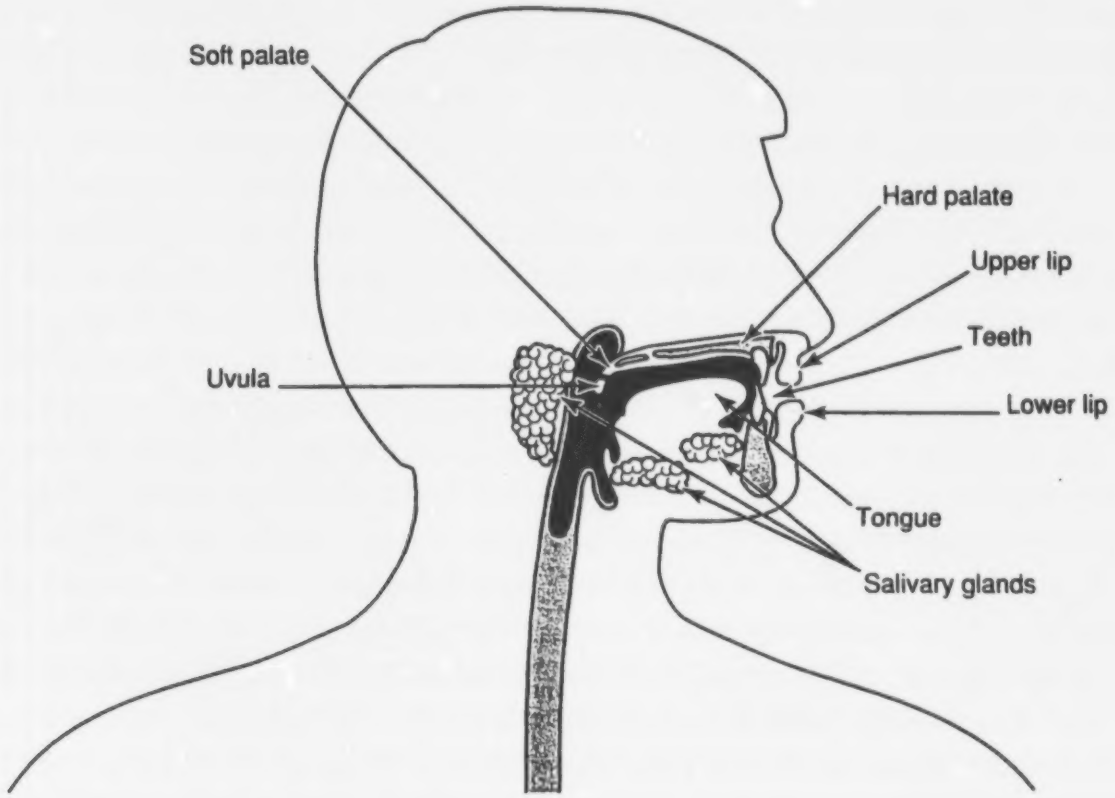


Figure 3
Major structures of the mouth

OBJECTIVE 10

Complete statements that describe the characteristics and structures of the teeth.

1. **Two sets of teeth develop during life: the deciduous teeth and the permanent teeth** (see Figure 5 on page 17).

KEY TERM

Deciduous (di-si´-juh-wuhs)—Referring to a structure that is given up at the end of a growth period

✔ **NOTE:** The trees that lose their leaves in autumn are deciduous trees.

2. **The 20 deciduous teeth usually emerge sometime between 6 to 12 months after birth and are generally shed by the age of 13 years.**

3. **The 32 permanent teeth usually emerge between the ages of 6 and 17 years.**

4. **The teeth are set in sockets called *alveolar processes*; the alveoli are lined with periodontal membrane that attaches the teeth to the socket.**

KEY TERMS

Alveolus (al-ve´-uh-luhs)—A small, saclike structure

Process (praw´-ses)—A natural growth that projects from a bone

peri- (pir´-e)—Prefix meaning "all around" or "surrounding"

Periodontal (per-e-o-dawn´-tuhl)—Of or pertaining to the area around the tooth

5. **The sockets are covered by the gums—also called the *gingiva*** (jin´-juh-vuh)**—which are dense connective tissue covered by mucous membrane** (see Figure 4 on the next page).

6. **A tooth consists of three major sections: the root, the neck, and the crown** (see Figure 4 on the next page).

7. **The root of a tooth extends into the socket, where it is anchored by the peridontal membrane.**

8. **The neck is the part of the tooth that joins the root to the exposed portion of the tooth, which is called the *crown*** (see Figure 4 on the next page).

9. **The crown is covered with a hard substance called *enamel*** (see Figure 4 on the next page).

10. **Enamel overlays a bone-like tissue called *dentin*** (see Figure 4 on the next page).

11. **Within the center portion of the tooth, nerves and blood vessels are encased in a softer tissue referred to as the *pulp cavity* or *pulp*** (see Figure 4 on the next page).

OBJECTIVE 11 **Label the major structures of a tooth** (see Figure 4).

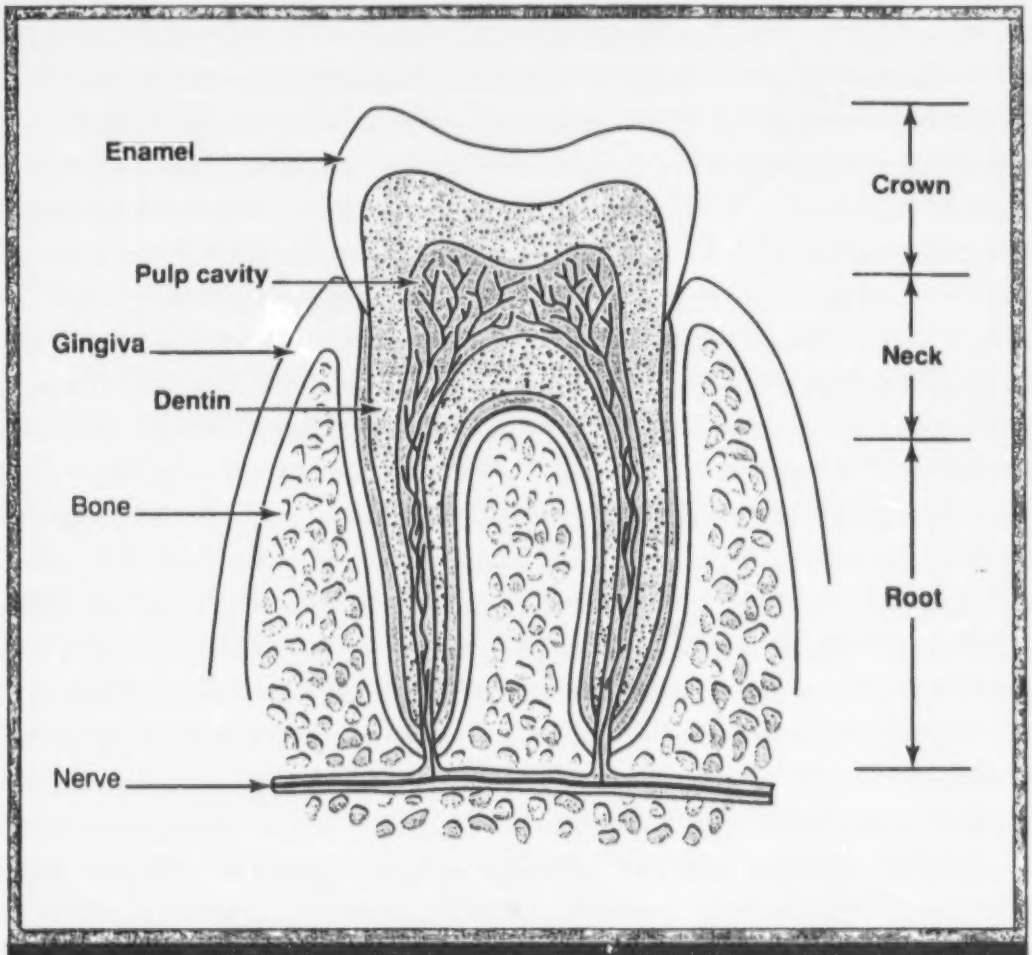


Figure 4
Major structures of a tooth

OBJECTIVE 12 **Define the types of teeth as classified by location and function** (see Figure 5 on the next page).

✔ **NOTE:** Humans eat various types of food, which means that our teeth must be able to chew foods of various textures, differing degrees of toughness, etc. Therefore, our teeth have specific shapes and locations within the mouth to perform different functions.

1. **Incisor** (in-si´-zuhr)—One of the eight wedge-shaped front teeth, four in each dental arch, that is adapted for biting food

2. **Cuspid** (kuhs´-puhd)—One of four pointed teeth, two in each dental arch, that is located at the side and toward the front of the mouth and is adapted for biting and tearing food

   ✔ **NOTE:** The cuspids are also called the *canine teeth*.

3. **Premolar**—One of eight teeth, four in each dental arch, that is located in the middle section of the mouth and is adapted for grinding food

   ✔ **NOTE:** The premolars are also called the *bicuspids* (bi-kuhs´-puhds).

4. **Molar**—One of twelve teeth, six in each dental arch, that is located in the posterior section of the mouth and is adapted for crushing food

   ✔ **NOTE:** The first and second molars are also called the *tricuspids* (tri-kuhs´-puhds); the third molars are also called the *wisdom teeth.*

OBJECTIVE 13 **Label the types of teeth as classified by location and function** (see Figure 5).

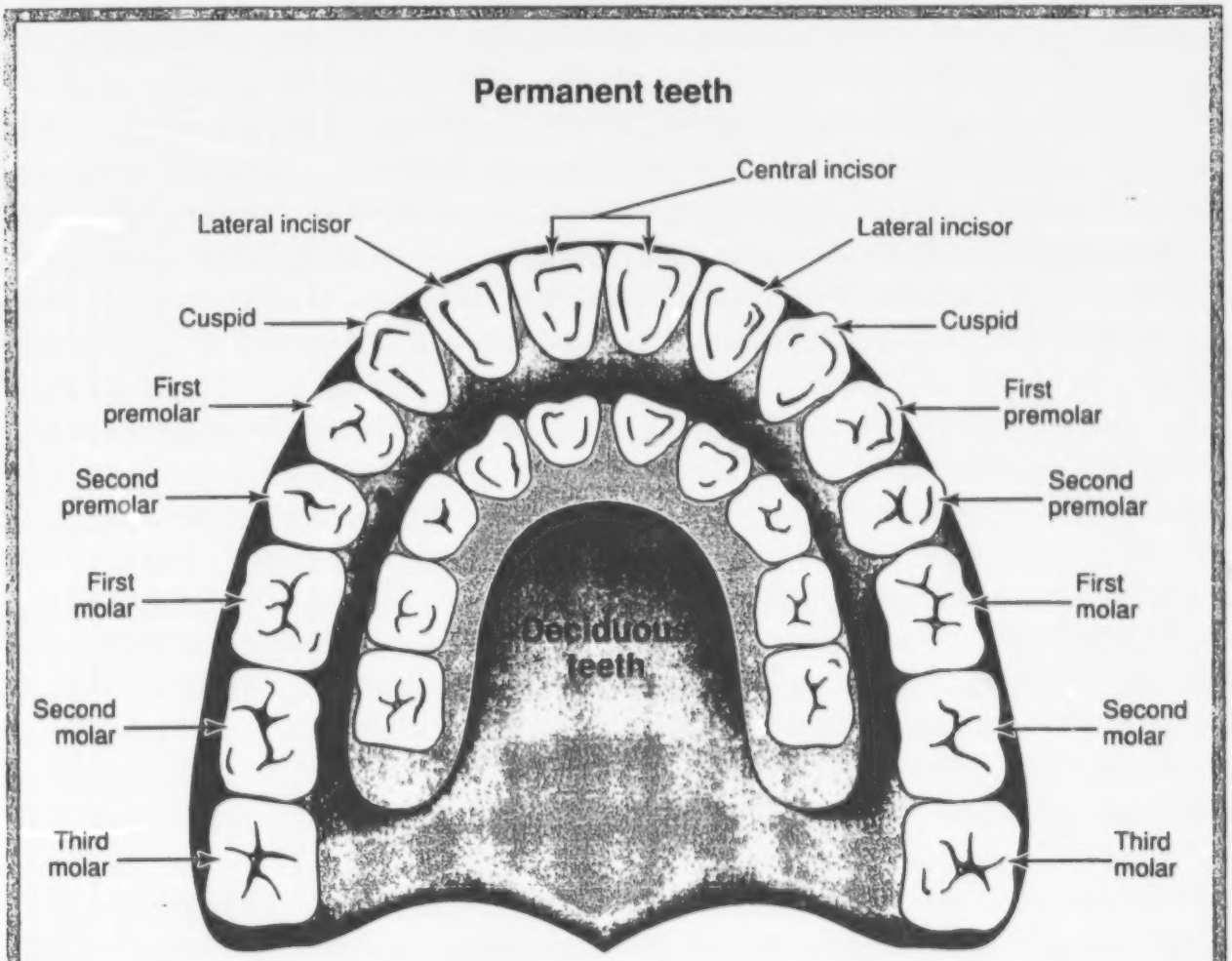


Figure 5
Types of teeth as classified by location and function

OBJECTIVE 14

Complete statements that describe the characteristics and structures of the pharynx that relate to the digestive system.

✔ **NOTE:** You are somewhat familiar with the structure of the pharynx because of your study of the respiratory system.

1. **The pharynx consists of three parts: the nasopharynx** (na-zo-far´-in{k}s), **the oropharynx** (or-uh-far´-in{k}s), **and the laryngopharynx** (luh-rin´-guh-far´-in{k}s).
2. **The nasopharynx is located in the superior portion of the throat behind the nasal cavity above the palate.**
3. **The oropharynx is located in the middle portion of the throat behind the mouth between the palate and the hyoid bone.**
4. **The laryngopharynx is located in the inferior portion of the throat just above the larynx and below the hyoid bone.**

OBJECTIVE 15

Complete statements that describe the characteristics and structures of the esophagus.

1. **The esophagus is a muscular, collapsible tube about 10 inches (250 millimeters) long.**
2. **The top portion of the esophagus has no peritoneal coat as it lies in the thoracic cavity.**
3. **The esophagus goes through the esophageal hiatus in the diaphragm in its descent from the thoracic cavity to the abdominal cavity.**
4. **Food is propelled into the stomach by peristalsis** (per-uh-stol´-suhs), **the coordinated, rhythmic contraction of smooth muscle that forces food through the digestive tract.**

KEY TERMS

Peritoneal (per-uh-tuhn-e´-uhl)—Relating to the smooth, transparent serous membrane that lines the cavity of the abdomen

Hiatus (hi-a´-tuhs)—A normal opening in a membrane or other body tissue

OBJECTIVE 16

Define the major structures of the stomach (see Figure 6 on page 20).

1. **Fundus** (fuhn´-duhs)—The enlarged portion of the stomach that is located to the left and above the point where the esophagus opens into the stomach
2. **Body**—The central portion of the stomach
3. **Pylorus** (pi-lor´-uhs)—The lower portion of the stomach near the opening where the stomach empties into the small intestine

4. **Cardiac sphincter**—The opening that is located at the upper end of the stomach, where the esophagus joins the stomach

   ✔ **NOTE:** The cardiac sphincter is normally closed to prevent gastric juices from backflowing into the esophagus, but it opens to allow food to enter the stomach or **vomitus** to exit the stomach.

5. **Pyloric sphincter**—The opening at the lower end of the stomach, where the stomach joins the small intestine

   ✔ **NOTE:** The pyloric sphincter is normally closed so that food is held in the stomach for digestion, but it opens to allow **chyme** to pass into the small intestine.

6. **Lesser curvature**—The upper concave edge of the stomach that extends from the cardiac sphincter to the pyloric sphincter

7. **Greater curvature**—The lower convex edge of the stomach that extends from the cardiac sphincter to the pyloric sphincter

KEY TERMS

Sphincter (sfin{k}´-tuhr)—A circular band of muscle fibers that constricts a passage or closes a natural opening in the body

Vomitus (vaw´-muh-tuhs)—The stomach and intestinal contents that are expelled by vomiting

✔ **NOTE:** As a result of irritation of the stomach caused by food poisoning, motion sickness, disease, or other conditions, the medulla may signal the contraction of the diaphragm and abdominal muscles to cause the expulsion of the contents of the stomach and upper intestine. This is the process of vomiting or regurgitation (re-guhr-juh-ta´-shuhn). As part of this reflex, the stomach sphincters relax and the glottis closes to prevent vomitus from entering the trachea.

Chyme (kim´)—The semifluid mass of partly digested food expelled by the stomach into the small intestine

OBJECTIVE 17 **Label the major structures of the stomach** (see Figure 6).

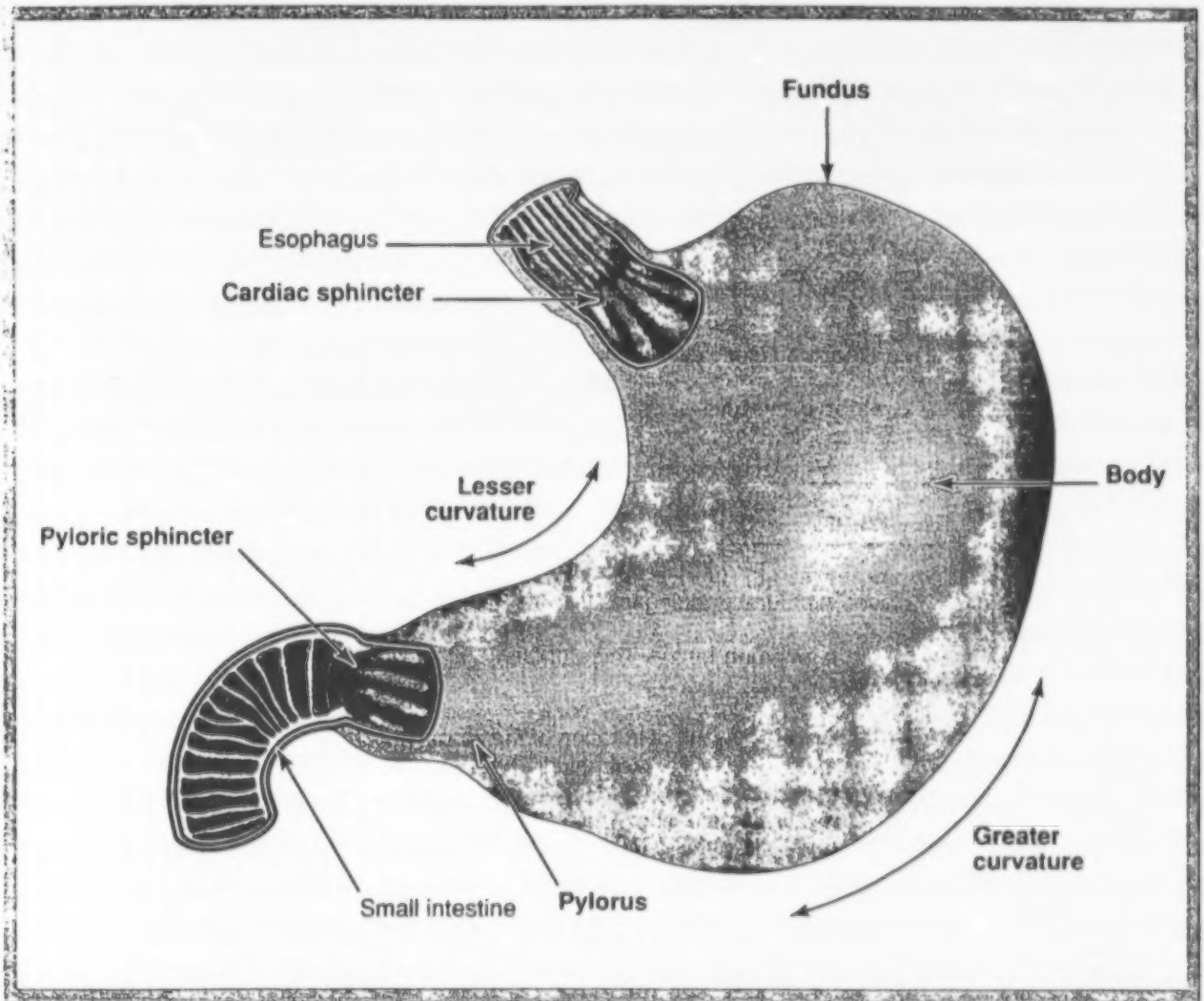


Figure 6
Major structures of the stomach

OBJECTIVE 18 **Complete statements that describe the characteristics and functions of the stomach.**

1. **The stomach is an elongated, flexible pouch that varies in size because it is able to dilate according to the amount of food contained within it.**
2. **The lining of the stomach—called the *mucosa*—contains folds called *rugae*** (ru´-gi).
3. **When there is little or no food or drink in the stomach, the rugae collapse, making the stomach smaller; as the stomach fills, the rugae distend, making the stomach larger.**

4. **Normally, the stomach can hold up to approximately 2 quarts (2 liters) until the chyme is ready to be received into the small intestine.**

5. **The mucosa contains glands and gland openings called *gastric pits*; cells in the gastric pits secrete three primary gastric juices: mucus, pepsinogen** (pep-si´-nuh-juhn), **and hydrochloric acid (HCL).**

6. **Mucus coats and protects the stomach against acid; pepsinogen converts into pepsin** (pep´-sin) **in the presence of hydrochloric acid, and pepsin is an enzyme that breaks down proteins.**

OBJECTIVE 19 **Define the major structures of the small intestine.**

1. **Duodenum** (du-uh-de´-nuhm or du-aw´-duhn-uhm)—The 10-inch-long (25-centimeter-long) upper part of the small intestine that extends from the pyloric sphincter of the stomach to the jejunum

   ✔ **NOTE:** The duodenum is the shortest and broadest part of the small intestine and is a common site for ulcers.

2. **Jejunum** (ji-ju´-nuhm)—The 8-foot-long (2.5-meter-long) middle part of the small intestine that extends from the duodenum to the ileum

3. **Ileum** (i´-le-uhm)—The 12- to 15-foot-long (4- to 5-meter-long) lowest part of the small intestine that extends from the jejunum to the large intestine

4. **Ileocecal** (il-e-o-se´-kuhl) **valve**—The valve between the ileum of the small intestine and the cecum (se´-kuhm) of the large intestine; it consists of a flap of tissue that serves as a sphincter to prevent feces from backing up into the small intestine

   ✔ **NOTE:** See Objective 21 for the definition of the term *cecum*.

OBJECTIVE 20 **Complete statements that describe the characteristics and functions of the small intestine.**

1. **Most digestion and nutrient absorption occurs in the small intestine.**

2. **The small intestine contains rugae and villi** (vi´-li)**—microscopic, velvety, finger-like projections.**

3. **Each villus consists of a lymph channel called a *lacteal*** (lak´-te-uhl), **which absorbs fats.**

4. **The rugae and the villi increase the surface area of the small intestine, slowing the movement of chyme, exposing the chyme to more digestive secretions, and allowing more nutrients to be absorbed through the intestine.**

5. **As food is digested, nutrients pass into the capillaries and lacteals of the villi.**

OBJECTIVE 21

Define the major structures of the large intestine (see Figure 7 on the next page).

1. **Cecum** (se´-kuhm)—The 2- to 3-inch-long (5- to 7.5-centimeter-long) blind pouch at the beginning of the large intestine into which the ileum opens

2. **Vermiform appendix**—The 3- to 6-inch-long (7.5- to 15-centimeter-long) wormlike process extending from the cecum

✔ **NOTE:** The vermiform appendix is also called the *cecal appendix*. The vermiform appendix is generally considered to be a vestigial organ—one that appears to have atrophied and become useless.

KEY TERMS

Vermiform (vuhr´-muh-form)—Resembling a worm

Appendix (uh-pen´-diks)—An accessory part of a main structure

3. **Colon** (ko´-luhn)—The approximately 5-foot-long (1.6-meter-long) portion of the large intestine that extends from the cecum to the rectum

✔ **NOTE:** The colon is a continuous tube that is divided into four sections. You will study these sections in Objective 22.

4. **Rectum** (rek´-tuhm)—The 7- to 8-inch-long (17.5- to 20-centimeter-long) portion of the large intestine that extends from the colon to the anal canal

5. **Anal** (a´-nuhl) **canal**—The 1- to 1½-inch-long (2.5- to 3.5-centimeter-long) terminal portion of the large intestine that ends at the anus

✔ **NOTE:** The anus contains an internal sphincter muscle and an external sphincter muscle that are closed except during defecation. The anal canal's mucous lining is arranged in numerous vertical folds known as *rectal columns* or *Houston valves*, which each contain an artery and a vein. The veins in the rectal columns or anal columns can become dilated as a result of direct irritation, such as pregnancy or constipation.

OBJECTIVE 22

Define the sections and flexures of the colon (see Figure 7 on the next page).

✔ **NOTE:** The large intestine consists of four major sections arranged roughly in a square. The bends of the colon that form the corners of the top of the square are called *flexures* (flek´-shuhrs) and are named for the organs near their locations.

1. **Ascending colon**—The portion of the colon that lies in a vertical position on the right side of the abdomen and extends to the lower border of the liver, where it bends abruptly to the left

2. **Hepatic flexure**—The abrupt bend of the ascending colon at the lower border of the liver; also called the *right colic flexure*

3. **Transverse colon**—The portion of the colon that passes across the upper abdomen, below the liver and stomach, and above the small intestine, to the spleen in the upper-left abdomen, where it curves sharply downward to the right beneath the lower end of the spleen

4. **Splenic flexure**—The sharp downward bend of the transverse colon in the upper-left abdomen; also called the *left colic flexure*

5. **Descending colon**—The portion of the colon that lies in a vertical position on the left side of the abdomen and extends from a point below the stomach to the level of the iliac crest, where it begins an S-shaped curve

6. **Sigmoid colon**—The portion of the colon that extends from the descending colon and curves downward in an S-shape to join the rectum

OBJECTIVE 23

Label the major structures of the large intestine (see Figure 7).

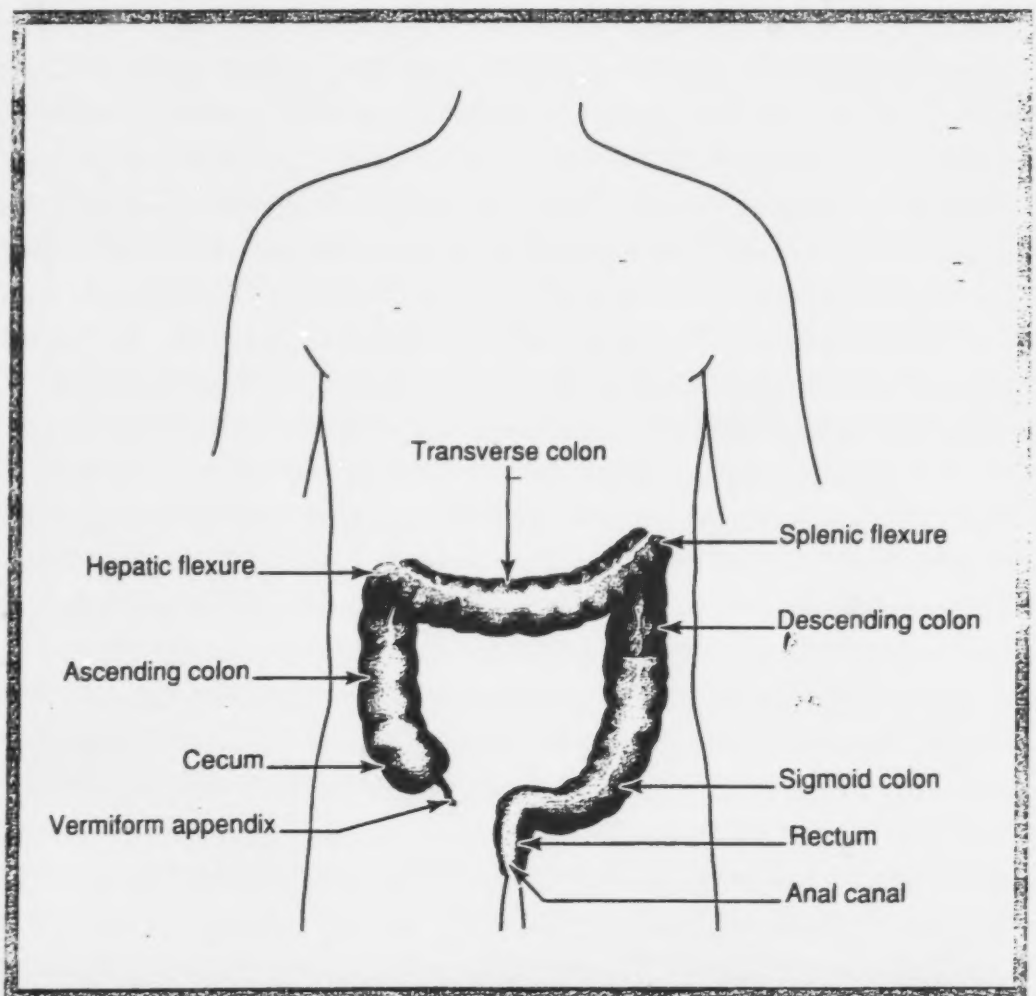


Figure 7
Major structures of the large intestine

OBJECTIVE 24

Complete statements that describe the characteristics and functions of the large intestine.

1. **The principal functions of the colon are to absorb water, minerals, and vitamins and to eliminate waste.**
2. **Three bands of muscle give the colon its structure, with the rest of the colon gathered to these bands in pouches called *haustra*** (haws´-truh), **which increase the surface area of the colon and allow the large intestine to expand.**
3. **As feces cause the colon to expand, the defecation reflex sets off peristaltic motion to move feces through the intestine and toward the anal canal.**
4. **The mucous lining of the large intestine has no villi and the large intestine does not secrete enzymes, but it does secrete mucus to help lubricate feces as they move through the colon.**
5. **The mucous lining of the large intestine contains intestinal glands and solitary lymph nodes.**

OBJECTIVE 25

Complete statements that describe the characteristics and structures of the liver.

1. **The liver is completely covered by a tough, fibrous sheath called *Glisson's*** (glis´-uhnz) ***capsule*.**
2. **The upper convex surface of the liver** (see Figure 8 on page 28) **fits under the diaphragm.**
3. **The lower concave portion of the liver** (see Figure 8 on page 28) **fits over the kidney, ascending colon, and pyloric end of the stomach.**
4. **The liver is the first organ to receive blood from the intestines after nutrient absorption.**
5. **Blood is provided to the liver through the portal vein so that the liver can detoxify the blood before it returns to the heart.**

   ✔ **NOTE:** Because toxins can enter the body through the mouth and digestive tract, it is important that substances absorbed through the walls of the small intestine be filtered and purified before spreading through the rest of the body. Thus, the portal vein carries blood from the point of nutrient exchange to the liver.

6. **The liver is divided into two main lobes: the right lobe and the left lobe** (see Figure 8 on page 28).
7. **The right lobe is the largest lobe and constitutes approximately 80 percent of the total mass of the liver.**
8. **The left lobe is the smaller wedge-shaped lobe.**
9. **The right lobe is divided into sublobes: the quadate lobe, the caudate lobe, and the spigelli** (spuh-gal´-le) **lobe.**

KEY TERMS

Quadate (kwaw´-dat)—Four-sided

Caudate (ko´-dat)—Having a tail

10. **The entire liver is subdivided into lobules, each served by a small branch of the hepatic vein.**

11. **The lobes and lobules are separated by blood vessels and by fibrous strands of Glisson's membrane peritoneum that are called *ligaments*.**

12. **The major ligament of the liver is called the *falciform ligament*, which separates the liver into the right and left lobes** (see Figure 8 on page 28).

KEY TERM

Falciform (fal´-suh-form)—Shaped like a sickle

13. **Small bile ducts within the liver join to form two larger ducts that emerge from under the concave surface of the liver as the right and left hepatic ducts and immediately join to form the common hepatic duct** (see Figure 8 on page 28).

14. **The common hepatic duct joins the cystic duct from the gallbladder to form the common bile duct** (see Figure 8 on page 28).

15. **The common bile duct opens into the duodenum at an enlargement called the *ampulla*** (am-pu´-luh) ***of Vater*, which is located 3 to 4 inches (75 to 100 millimeters) below the pyloric opening of the stomach.**

16. **The neck of the ampulla of Vater is guarded by a sphincter muscle called the *sphincter of Oddi*.**

OBJECTIVE 26 **List the functions of the liver.**

1. **Produces bile, which is stored in the gallbladder and is released when needed for the digestive process**

   ✔ **NOTE:** Bile is mostly water but does contain bile salts, which are able to emulsify (i-muhl´-suh-fi) fats in the small intestine. Emulsification is a physical—not a chemical—process. The fats are merely broken into smaller chains of fat; however, the smaller groups of fats are more easily digested.

2. **Forms an internal secretion that regulates the conversion of glucose into glycogen**

   ✔ **NOTE:** Excess glucose in the blood is converted into glycogen for storage in the liver. This conversion is precipitated by the hormones insulin and cortisol as glucose-rich blood passes through the liver.

3. **Stores glycogen**

4. **Converts glycogen back into glucose as it is required for body functions**

   ✔ **NOTE:** If the blood-glucose level drops too low for normal functioning—a condition called *hypoglycemia* (hi-po-gli-se´-me-uh)—the liver secretes epinephrine and glucagon to convert the glycogen into glucose. This conversion may also occur during times of stress, when more than normal glucose is required to carry out body functions. The liver is also capable of converting other forms of sugar that the cells cannot use, such as fructose, into glucose.

5. **Stores iron and vitamins B_{12}, A, D, E, and K**

   ✔ **NOTE:** Vitamin B_{12} is a water-soluble vitamin—it will dissolve in water so that it can be transported to other areas of the body. A, D, E, and K vitamins are fat-soluble. The liver is capable of storing enough vitamin A and D to supply the body for up to a year. Because of these storage capacities, the consumption of animal and fish liver can be an excellent means of obtaining these vitamins as well as the minerals iron and copper.

6. **Changes proteins into urea for elimination**

   ✔ **NOTE:** There are 20 amino acids that the body requires for normal functioning. The liver produces 20 of these through the breakdown of proteins. Because amino acids cannot be stored, they are made available for protein production immediately or they are further converted. Excess amino acids have their ammonium (NH_4) molecules removed in the liver, leaving carbon chains that can be converted into carbohydrates or fat (available or stored energy). The separated NH_4 molecules are combined into urea for filtering by the kidneys and elimination in the urine.

7. **Manufactures fibrogen and prothrombin, which are used in blood clotting**

8. **Manufactures heparin, which helps prevent blood from clotting in intact vessels**

9. **Regulates blood volume**

   ✔ **NOTE:** Through the production of fibrogen, prothrombin, and other plasma proteins, such as albumin and globulins, the liver is able to regulate blood volume.

10. **Manufactures antibodies**

11. **Removes bacteria and foreign substances from the bloodstream by phagocytosis**

    ✔ **NOTE:** The liver contains macrophages called *Kupffer cells*. These macrophages do not circulate through the bloodstream but remain in the liver. Their main purpose is to destroy wornout red blood cells and pathogens that enter the bloodstream through the digestive system. This includes some organisms that assist with the digestive processes in the intestines but which might be harmful if allowed to settle in another part of the body. A portion of the phagocytized red blood cells is converted into bilirubin (bi-li-ru´-buhn), a component of bile.

12. **Produces body heat**

13. **Detoxifies harmful substances, such as drugs and poisons, before they make their way to the heart**

14. **Manufactures cholesterol**

✔ **NOTE:** Cholesterol (kuh-les´-tuh-rol) is a steroid synthesized by the liver and used in the walls of cells.

OBJECTIVE 27

Complete statements that describe the characteristics and structures of the pancreas.

1. **The pancreas lies transversely behind the stomach and duodenum, and the body of the pancreas extends horizontally across the posterior abdominal wall** (see Figure 8 on the next page).

2. **The pancreas is divided into the head, body, and tail.**

3. **The head of the pancreas fills the C-curve of the duodenum, to which it is firmly attached.**

4. **The tail of the pancreas touches the spleen.**

5. **The pancreas varies in size according to the sex of the person and other individual factors, but it is generally 6 to 9 inches (150 to 225 millimeters) long, 1 to 1½ inches (25 to 40 millimeters) in width, and 1 inch (25 millimeters) thick and weighs 2 to 3 ounces (30 to 60 grams).**

6. **Special cells of the pancreas manufacture pancreatic juice, which is carried by the pancreatic duct to the duodenum.**

7. **The pancreatic duct—called the duct of Wirsung** (wer´-sung)**—and the common bile duct unite to form the ampulla of Vater** (see Figure 8 on the next page).

8. **The pancreas also has special cells called *islands (islets) of Langerhans*** (lan´-guhr-hawns) **that lie in clusters between the pancreatic cells and are scattered throughout its structure.**

9. **The islands of Langerhans produce insulin and glucagon, which are absorbed directly into the blood vessels.**

OBJECTIVE 28

Complete statements that describe the characteristics and structures of the gallbladder.

1. **The gallbladder is about 3 to 4 inches (75 to 100 millimeters) long, 1 inch (25 millimeters) wide, and holds about 2 cubic inches (36 cubic centimeters) of bile.**

2. **The gallbladder consists of three layers: the inner mucous-membrane layer, the middle muscular- and fiber-tissue layer, and the outer serous-membrane layer.**

3. **The gallbladder and bile ducts have involuntary muscles in their walls that are capable of contracting and forcing bile into the duodenum.**

OBJECTIVE 29 **Label the major structures of the liver, pancreas, and gallbladder** (see Figure 8).

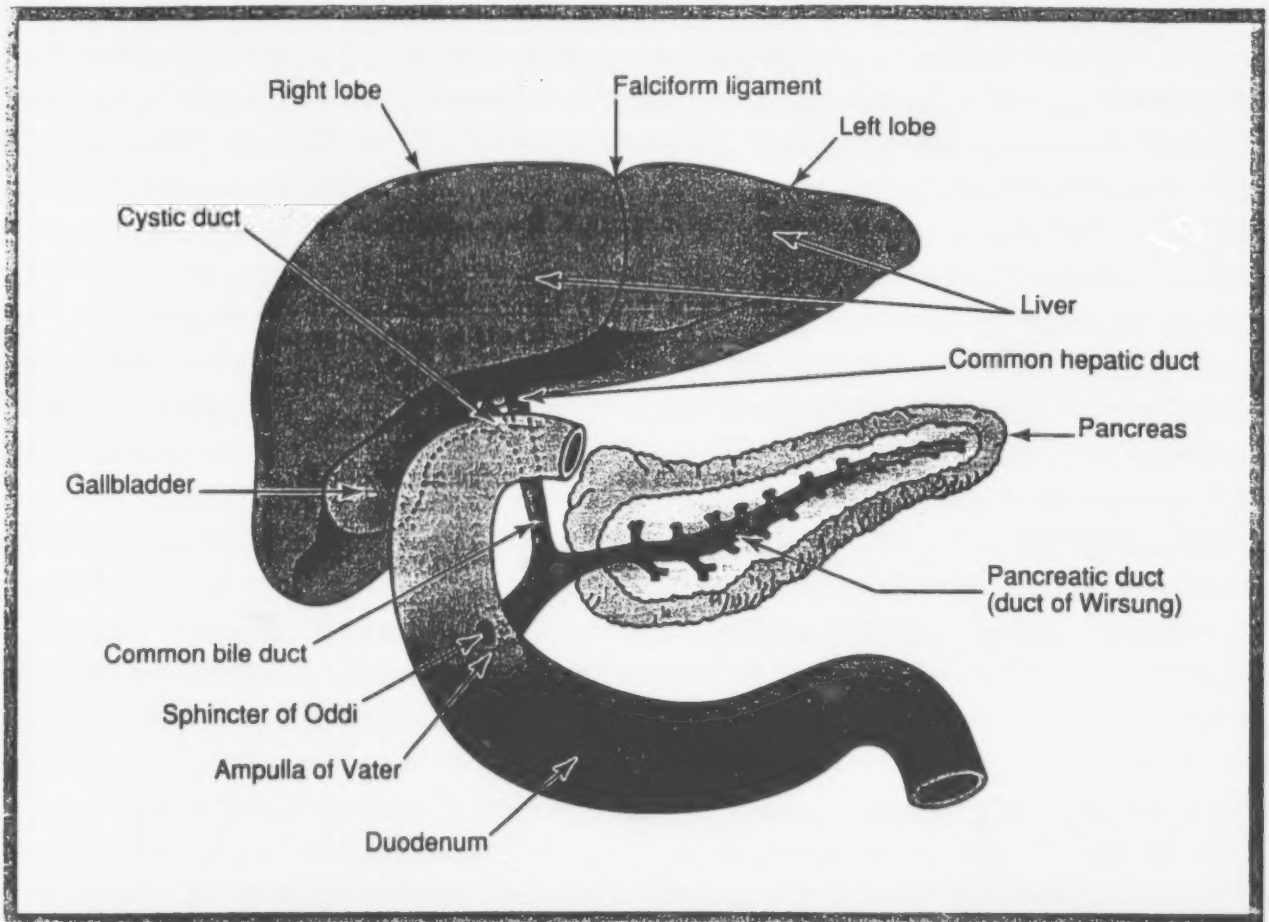


Figure 8
Major structures of the liver, pancreas, and gallbladder

OBJECTIVE 30 **Match common disorders and abnormalities of the alimentary tract to their correct definitions.**

1. **Pyloric stenosis**—Abnormal narrowing of the pyloric opening, which is generally the result of a birth defect but may be a symptom of some physical condition such as scarring or tumoral growth

KEY TERMS

Pyloric (pi-lor´-ik)—Of or relating to the pylorus, the opening from the stomach into the intestine

Stenosis (stuh-no´-suhs)—Any abnormal narrowing or constriction of an opening or duct

2. **Gastric ulcer**—An ulcer of the stomach lining characterized by episodes of burning pain, belching, and nausea

KEY TERM

Gastric (gas´-trik)—Of or relating to the stomach

3. **Duodenal ulcer**—An ulcer of the duodenum characterized by a gnawing pain

4. **Appendicitis** (uh-pen-duh-si´-tuhs)—An inflammation of the vermiform appendix that is usually acute and is characterized by constant pain in the right lower quadrant of the abdomen

   ✔ **NOTE:** Appendicitis is usually addressed by a surgical procedure called an *appendectomy* (a-puhn-dek´-tuh-me).

5. **Peritonitis** (per-uh-tuhn-i´-tuhs)—An inflammation of the peritoneum that is produced by bacteria or irritating substances introduced into the abdominal cavity by a penetrating wound or perforation of an organ

6. **Biliary calculus**—A gallstone; a stone formed in the gallbladder or bile ducts, consisting of cholesterol or bile pigments and calcium salts and causing pain in the right upper quadrant, obstruction, and inflammation

KEY TERMS

Biliary (bi´-le-er-e)—Of or relating to or conveying bile

Calculus (kal´-kyuh-luhs)—A hard mass of mineral salts around organic material found especially in hollow organs or ducts

7. **Diverticulosis** (di-vuhr-ti-kyuh-lo´-suhs)—The presence of pouchlike herniations through the muscular layer of the colon—particularly the sigmoid colon—that is characterized by bleeding from the rectum

   ✔ **NOTE:** The pouchlike herniations are called *diverticula* (di-vuhr-ti´-kyuh-luh). A diverticulum is a sac that forms in a weak spot in the wall of a hollow organ, such as the intestines. A few small diverticula are not likely to cause any serious digestive problems. However, with diverticulosis, diverticula may become so numerous that they interfere with the normal passage of the by-products of digestion. Fecal materials, for example, may become impacted in diverticula, causing severe constipation. Diverticula can become infected and inflamed in a condition referred to as *diverticulitis* (di-vuhr-ti-kyuh-li´-tuhs).

8. **Food poisoning**—Any of various conditions that results from the introduction of pathogens or pathogenic toxins through the consumption of food that has been improperly cooked or stored

   ✔ **NOTE:** If food is not thoroughly cooked, organisms that are killed by heat may survive. Many foods must be refrigerated to slow the growth of harmful organisms. The

poisoning effect may be caused directly by the organism or by toxins produced by the organism so that normal cell functions are disrupted. Symptoms of food poisoning may range from mild nausea to vomiting and diarrhea to death. Common organisms involved in food poisoning include strains of *Listeria*, *Clostridium* (botulism), *Salmonella*, and *Escherichia coli*.

9. **Intolerance** (in-tawl´-ruhn{t}s)—A condition in which an organ is unable to process a substance, such as a type of food, that would normally be processed

   ✔ **NOTE:** There are many forms of intolerance, most of which are caused by the absence of an enzyme or the insufficient production of an enzyme. For example, a common form of intolerance is the inability to digest milk or milk products. This is often the result of the body's inability to produce lactase, the enzyme that breaks down the milk-sugar lactose. Thus, this condition is referred to as *lactose intolerance*.

10. **Paralytic ileus**—The loss of peristalsis in the intestine, causing the movement of chyme through the digestive system to cease

    ✔ **NOTE:** With the loss of peristalsis, the accumulating chyme, food, and feces may lead to total obstruction of the bowels. The paralysis usually results from peritonitis, surgery, or environmental factors such as chemicals that are inhaled or ingested.

KEY TERMS

Paralytic (par-uh-li´-tik)—Affected with paralysis

Ileus (i´-le-uhs)—Mechanical or functional obstruction of the intestine

11. **Hepatitis** (he-puh-ti´-tuhs)—Inflammation of the liver caused by several different viruses, though the vast majority of cases are caused by one of three strains of viruses, leading to the designations hepatitis A, B, and C

    ✔ **NOTE:** Hepatitis A is the least severe and is generally spread via food that has been handled by an infected person or via shellfish that have fed in sewage-contaminated waters. Hepatitis B and C are most often spread by contact with blood, semen, or other body fluids from an infected person or a carrier. For this reason, health-care workers are frequently vaccinated against hepatitis B and donated blood is tested for all three forms.

12. **Mumps**—A viral infection that causes swelling of the parotid salivary glands and is most likely to affect children between 5 and 15 years of age, but may occur at any age

    ✔ **NOTE:** Mumps can affect a number of organs, especially in adulthood cases. In addition to the parotid gland, another organ of digestion that can be affected is the pancreas, which can also become inflamed.

13. **Malocclusion** (ma-luh-klu´-zhuhn)—Misalignment of teeth due to the positioning of the jaw, to alignment of individual teeth, or to missing teeth

14. **Tooth decay**—Permanent damage to the enamel and often underlying layers of a tooth as a result of the chemical actions of acids produced by bacteria, particularly where food and plaque (plak´) accumulate

15. **Gingivitis** (jin-juh-vi´-tuhs)—Inflammation or infection of the gums in which the gums are swollen and red and bleed

    ✔ **NOTE:** Most gingivitis is the result of poor oral hygiene and of the accumulation of bacterial plaque on the teeth, but gingivitis may be a sign of other conditions, such as diabetes, leukemia, or vitamin deficiency.

16. **Periodontitis** (per-e-o-dawn´-ti-tuhs)—Inflammation of the structures that attach the tooth to the bones of the jaw, which include the **periodontal ligament**, the gingiva, and the alveolar bone

KEY TERM

Periodontal ligament (PDL)—The fibrous tissue that attaches the teeth to the alveoli

17. **Heartburn**—A sensation of burning behind the sternum and other symptoms as a result of gastric acids escaping into the esophagus that is often caused by excessive pressure on the cardiac sphincter or a weakening of that opening

    ✔ **NOTE:** The excessive pressure may be the result of an unusually large meal, a physical condition such as a hernia, or simply from lying down immediately after eating. Some foods, such as chocolate or fatty foods, cause the sphincter to relax and may lead to heartburn. Chronic heartburn is likely to be the result of a defect in the sphincter itself.

18. **Hemorrhoid** (hem´-roid)—An enlarged, abnormally dilated vein of the anal canal

19. **Proctitis** (prawk-ti´-tuhs)—Inflammation of the rectum and anus caused by infection, trauma, drugs, allergy, or radiation injury and characterized by rectal discomfort and the repeated urge to pass feces with the inability to do so

20. **Anal fistula** (fis{h}´-chuh-luh)—An abnormal passageway that develops between the rectal wall and the skin, often in association with bowel diseases such as **Crohn's disease**

KEY TERM

Crohn's (kronz´) **disease**—A chronic inflammatory bowel disease usually affecting the ileum, the colon, or both structures

✔ **NOTE:** Crohn's disease is usually characterized by frequent attacks of diarrhea, severe abdominal pain, nausea, fever, chills, weakness, anorexia, and weight loss.

21. **Diarrhea** (di-uh-re´-uh)—A condition of unusually frequent and often watery or loose bowel movements that can be symptomatic of a number of diseases, conditions, and emotional states

22. **Constipation** (kawn(t)-stuh-pa´-shuhn)—A condition of unusually infrequent and often difficult bowel movements that can be symptomatic of a number of diseases or conditions

23. **Emesis** (e´-muh-suhs)—Vomiting

24. **Anorexia** (a-nuh-rek´-se-uh)—A loss of appetite

    ✔ **NOTE:** Anorexia is the general term for a loss of appetite associated with a medical condition. Common usage has tended to limit the term to a specific mental condition properly called *anorexia nervosa*, which is an avoidance of food consumption due to psychological factors.

25. **Nausea** (no´-ze-uh)—An urge to vomit or an unsettled feeling in the stomach that may also be associated with an aversion to food

26. **Gastroenteritis** (gas-tro-en-tuh-ri´-tuhs)—Inflammation of the stomach and intestines that accompanies numerous disorders of the alimentary tract and is characterized by anorexia, nausea, vomiting, abdominal discomfort, and diarrhea

27. **Malabsorption** (ma-luhb-sorp´-shuhn) **syndrome**—Any of various conditions that result in the inability of the digestive system, especially the small intestine, to absorb nutrients

    ✔ **NOTE:** Malabsorption syndrome may be a generalized condition affecting most nutrients or a condition limited to one or more specific nutrients.

28. **Colitis** (ko-li´-tuhs)—An inflammation of the large intestine characterized by severe diarrhea, bleeding, and ulceration of the mucosa of the intestine

    ✔ **NOTE:** Weight loss and pain are significant with colitis.

29. **Irritable-bowel syndrome**—A condition often brought on by stress that results in diarrhea or constipation

    ✔ **NOTE:** Most of the people affected with irritable-bowel syndrome are young adults, who complain of diarrhea and, occasionally, pain in the lower abdomen.

30. **Jaundice** (jon´-duhs)—A condition in which bilirubin is eliminated through the bloodstream instead of through the feces, resulting in yellowish discoloration of the skin, mucous membranes, and eyes and often a grayish discoloration of the feces

31. **Cirrhosis** (suh-ro´-suhs)—A condition of liver deterioration marked by the buildup of scar tissue when damage to the liver occurs at a rate faster than the liver is able to repair itself

    ✔ **NOTE:** The liver is able to regenerate damaged tissue with much more efficiency than most other organs. This is particularly important not only because of the many functions of the liver but also because the liver is especially subject to damage due to its role in detoxification. If damage from toxin occurs at too fast a rate, the liver cannot repair itself and cirrhosis will result. Common causes of cirrhosis are alcohol, drugs, and environmental chemicals.

32. **Pancreatitis** (pan-kre-uh-ti´-tuhs)—Inflammation of the pancreas, particularly as a result of blockage of the pancreatic duct

    ✔ **NOTE:** While pancreatitis may result from any of a number of conditions, one common cause is the disease cystic fibrosis in which the secretions of the pancreas become too thick to pass through the duct.

33. **Pancreatic cancer**—Cancer of the pancreas

34. **Liver cancer**—Cancer of the liver

35. **Stomach cancer**—Cancer of the stomach

36. **Colorectal cancer**—Cancer of the colon or rectal area

OBJECTIVE 31

Assignment Sheet 1—Practice Critical Thinking: Investigate Surgical Requirements for the Digestive System

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

Your studies of the digestive system should help you to understand the number of organs and potential disorders associated with this system. The stomach, intestines, liver, pancreas, and other structures are subject to conditions that may require surgical intervention. In this assignment sheet, you will be given the opportunity to explore those conditions and the procedures that may be required.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Read the investigation points on the next page. Your investigative report must include answers to all five of these investigation points.

_____ 3. Your instructor will assign you an organ and one or more conditions that may affect that organ. Write the name of that organ and the assigned conditions on the blanks provided on the next page.

_____ 4. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided on the next page.

_____ 5. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 6. Complete your investigation and give your investigative report to your instructor for evaluation.

Name of organ and assigned conditions _____

_____

_____

Format of investigative report _____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

INVESTIGATION POINT 1 Explain the chief medical cause of the assigned organ/disorder(s) of the digestive system.

INVESTIGATION POINT 2 Describe complicating factors that may contribute to this condition.

INVESTIGATION POINT 3 List and describe the medications that may be prescribed for this condition to avoid surgery.

INVESTIGATION POINT 4 Describe surgical procedures that may be necessary if medication proves ineffective.

INVESTIGATION POINT 5 Describe any dangers or complications that may be involved with the surgical procedures.

MODULE SET II:
Major Body Systems

Module 13: Urinary System

1344

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Investigate Treatment Options for End-Stage Renal Disease	23

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** — Pretest provided by your instructor.
- ❑ 2. **Stop** — Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** — Module Objective Sheet.
- ❑ 4. **Study** — Information Sheet, Objective 1 through Objective 19.
- ❑ 5. **Research** — Online resources to learn more about the urinary system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** — Written Test provided by your instructor.
- ❑ 7. **Stop** — Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** — Assignment Sheet 1, "Practice Critical Thinking: Investigate Treatment Options for End-Stage Renal Disease."
- ❑ 9. **Stop** — Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** — With your instructor for any additional assignments to be completed.

❑ 11.	Do	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	Take	Module Review provided by your instructor.
❑ 13.	Stop	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	Stop	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the urinary system, state the functions of the major structures of the urinary system, and define common disorders and abnormalities of the urinary system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *urinary system.*
2. State the functions of the urinary system.
3. Define the major organs and structures of the urinary system.
4. Label the major organs and structures of the urinary system.
5. Complete statements that describe the characteristics and external structure of the kidneys.
6. Define the major internal macroscopic structures of a kidney.
7. Label the major internal macroscopic structures of a kidney.
8. Complete statements that describe the characteristics of the internal microscopic structures of a kidney.
9. Label the major microscopic structures of a nephron.
10. State functions of the kidneys.
11. Complete statements that describe the characteristics and structure of the ureters.
12. Complete statements that describe the characteristics and structure of the urinary bladder.
13. Complete statements that describe the characteristics and structure of the female urethra.
14. Complete statements that describe the characteristics and structure of the male urethra.
15. Complete statements that describe the normal physical characteristics of urine.
16. Complete statements that describe the processes for producing and expelling urine.
17. List the common abnormal constituents of urine.
18. Complete statements that describe the characteristics of calculi in the urinary tract.

19. Define common disorders and abnormalities of the urinary system.

20. Practice critical thinking: investigate treatment options for end-stage renal disease. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *urinary system*.

■ **Urinary** (yur´-uh-ner-e) **system**—All of the organs involved in the secretion and elimination of **urine** (see Figure 1 below)

KEY TERM

Urine (yur´-uhn)—The waste material that is secreted by the kidneys

✔ **NOTE:** You will study more about urine in Objective 15 through Objective 17.

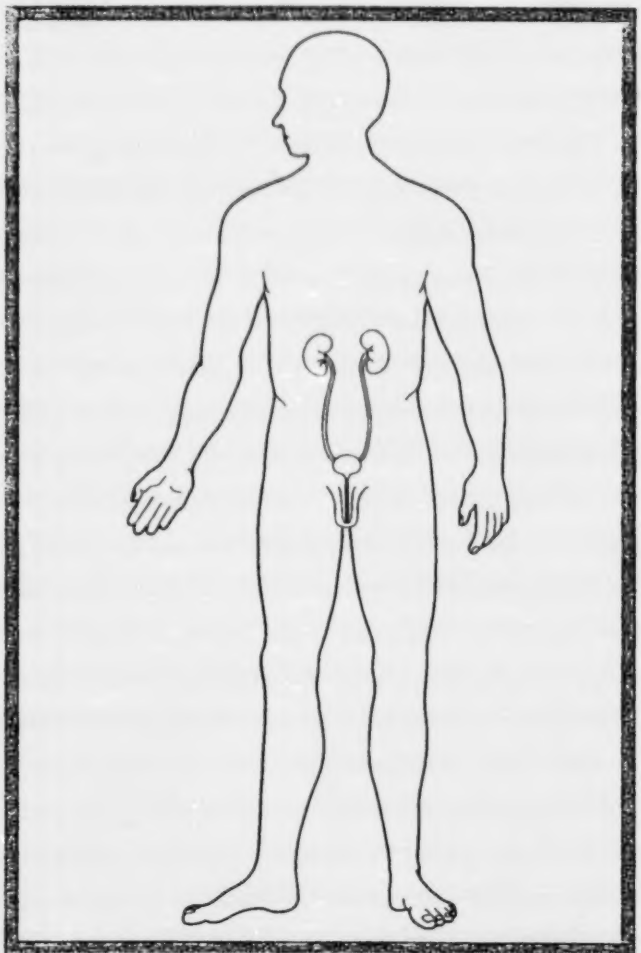


Figure 1
Urinary system

OBJECTIVE 2

State the functions of the urinary system.

1. **Filters the blood by removing various toxins, metabolic waste products, and some water**
2. **Manufactures and excretes urine**
3. **Assists in regulation of water, electrolyte, and acid-base balance of the body**
4. **Influences blood pressure**

OBJECTIVE 3

Define the major organs and structures of the urinary system (see Figure 2 on the next page).

1. **Kidney** (kid´-ne)—One of a pair of bean-shaped urinary organs in the dorsal part of the abdomen, one on each side of the vertebral column

   ✔ **NOTE:** You will study more about the kidneys in Objective 5 through Objective 10.

2. **Ureter** (yur´-uh-tuhr)—One of a pair of thick-walled tubes that carries urine from the kidney into the urinary bladder

   ✔ **NOTE:** You will learn more about the ureters in Objective 11.

3. **Urinary bladder**—The muscular membranous sac in the pelvis that stores urine for discharge through the urethra

   ✔ **NOTE:** You will study more about the urinary bladder in Objective 12.

4. **Urethra** (yu-re´-thruh)—The small, tubular structure that drains urine from the bladder

   ✔ **NOTE:** The structure of the urethra is different in the male and female. You will learn more about the male and female urethra in Objective 13 and Objective 14.

OBJECTIVE 4

Label the major organs and structures of the urinary system (see Figure 2).

✓ **NOTE:** For simplicity, the drawing below shows the male structure of the urethra.

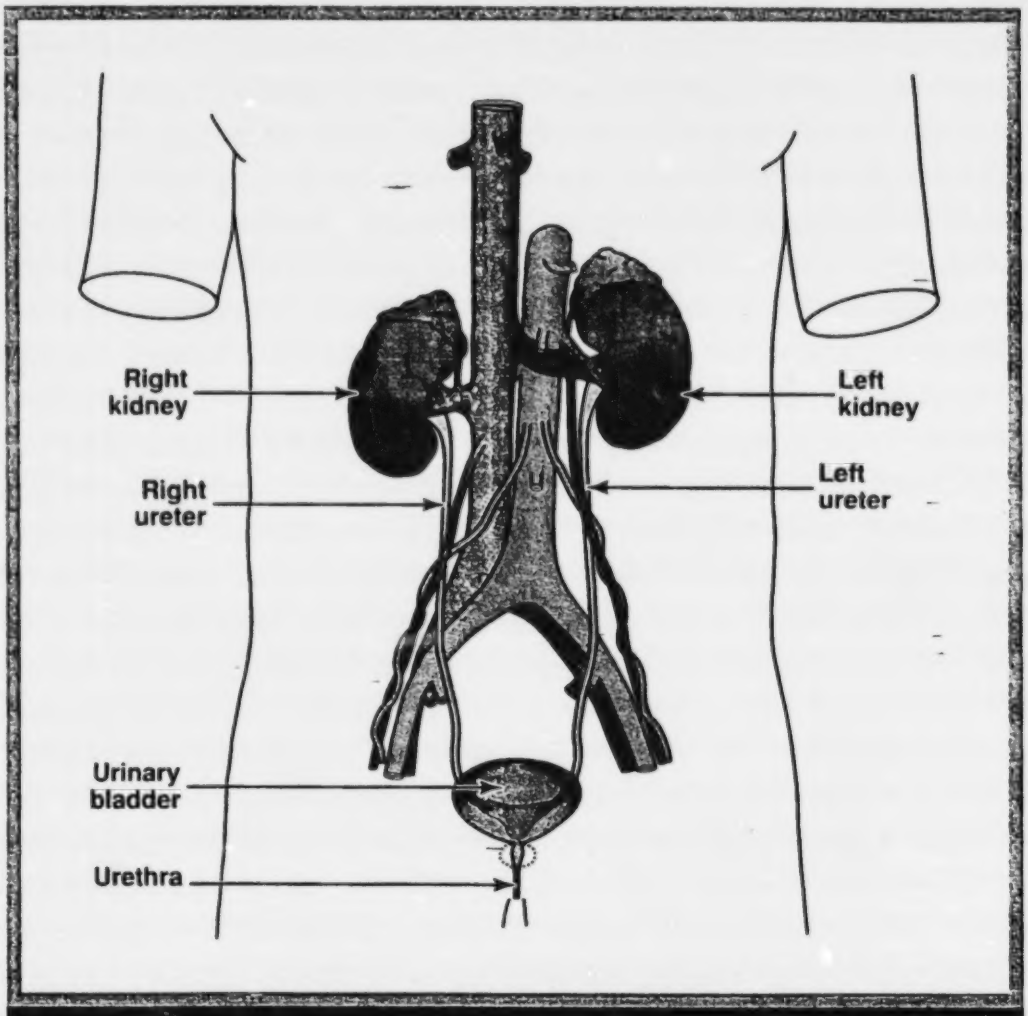


Figure 2.
Major organs and structures of the urinary system

OBJECTIVE 5

Complete statements that describe the characteristics and external structure of the kidneys.

1. **The kidneys lie behind the peritoneum, against the posterior wall of the abdomen.**

2. **Each kidney measures about 2½ by 4½ inches (6 to 11 centimeters), but the left kidney is usually slightly larger than the right kidney** (see Figure 2 above).

3. **The right kidney is usually a little lower than the left kidney** (see Figure 2 on the previous page) **because of the large space occupied by the liver.**

4. **Each kidney and its vessels are embedded in a pocket of fatty tissue called the *adipose capsule*, which protects the kidney from external blows and helps hold it in position.**

5. **The kidney and adipose capsule are suspended in a web of fibrous tissue called the *renal fascia*, which anchors the kidney to surrounding structures and also helps hold it in position.**

   ✔ **NOTE:** Occasionally a kidney may become dislodged from this suspension system, resulting in what is referred to as a *floating kidney*. While the kidney can function outside of the renal fascia, there is a danger that the kidney may twist and pinch the ureter.

6. **The depression on the inner (medial) border of each kidney** (see Figure 2 on the previous page and Figure 3 on the next page) **is called the *hilum*** (hi´-luhm).

7. **The renal artery enters and the renal vein exits each kidney at the hilum** (see Figure 2 on the previous page and Figure 3 on the next page).

KEY TERM

Renal (re´-nuhl)—Relating to the kidneys

8. **The renal artery carries blood containing waste products to microscopic structures in the kidney that filter out the waste products.**

   ✔ **NOTE:** You will study these microscopic structures in Objective 8 and Objective 9.

9. **Filtered blood leaves a kidney through the renal vein.**

OBJECTIVE 6 **Define the major internal macroscopic structures of a kidney** (see Figure 3 on the next page).

1. **Renal cortex**—The soft, granular, outer layer of a kidney

   ✔ **NOTE:** The renal cortex contains approximately 1.25 million **glomeruli** (see Figure 4 on page 13) that remove body wastes in the form of urine. You will learn more about the glomeruli in Objective 8 and Objective 9.

KEY TERM

Glomerulus (gluh-mer´-{y}uh-luhs)—A structure composed of capillaries

2. **Renal medulla**—The middle portion of the kidney that lies beneath the renal cortex and contains the cone-shaped structures called *renal pyramids*

   ✔ **NOTE:** The base of each renal pyramid joins the renal cortex. The narrow point of each pyramid—called the *renal papilla*—faces toward the hilum. The pyramids consist of the loops of Henle and the collecting tubules of the nephrons, which you will learn more about in Objective 8 and Objective 9.

3. **Renal pelvis**—The funnel-shaped inner portion of the kidney that contains the cuplike cavities called *calyces* (ka´-luh-sez), where urine is collected before it is sent to the ureter

   ✔ **NOTE:** Each calyx (ka´-liks) collects urine from the renal papilla of each renal pyramid.

OBJECTIVE 7 **Label the major internal macroscopic structures of a kidney** (see Figure 3).

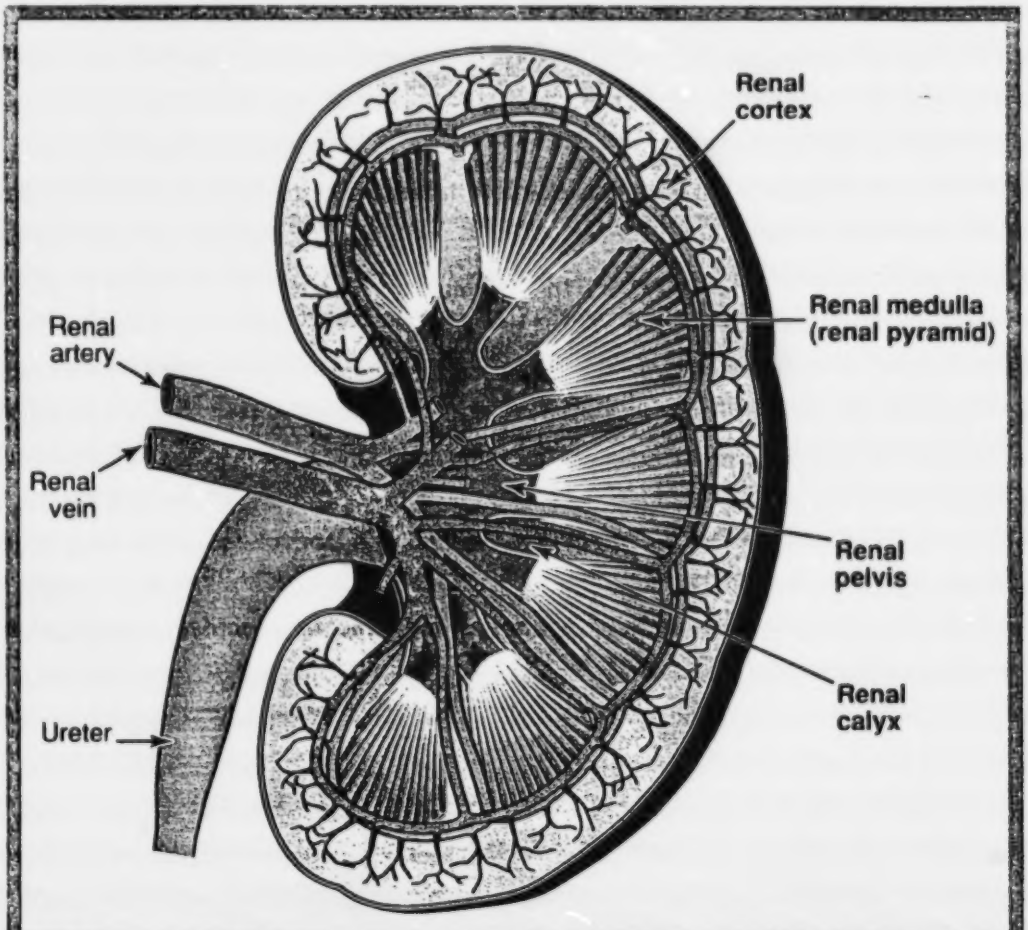


Figure 3:
Major internal macroscopic structures of a kidney

OBJECTIVE 8

Complete statements that describe the characteristics of the internal microscopic structures of a kidney.

1. **A nephron** (ne´-frawn) **is one of the approximately 1 million funnel-shaped microscopic structures located along the interface of the renal cortex and the renal medulla** (see Figure 4 on the next page).

   ✔ **NOTE:** The principal task of the kidneys is to remove waste products from the bloodstream and convert those wastes into urine for elimination from the body. The main functional unit involved in this process is the nephron. While the structure and functioning of the nephron are explained in more detail in this objective, an overview of the process may be helpful in explaining the structure and function of the kidneys. Essentially, small arteries deliver blood to the nephron where substances carried by the blood are emptied into the nephron. Water, nutrients, and glucose are returned to the venous system, while waste products and excess water flow through tubules to be eliminated as urine.

2. **Each nephron consists of two major structures called the *renal corpuscle* and the *renal tubule*.**

3. **A renal corpuscle consists of a glomerulus of renal capillaries enclosed within a funnel-shaped renal tubule called *Bowman's capsule*** (see Figure 4 on the next page).

4. **The renal tubule consists of four sections** (see Figure 4 on the next page)**: (1) the proximal convoluted tubule, (2) the loop of Henle** (hen´-le)**, (3) the distal convoluted tubule, and (4) the collecting tubule.**

   ✔ **NOTE:** The proximal convoluted tubule extends from the renal corpuscle and grows narrower. The proximal convoluted tubule exchanges substances with the circulatory system through tubular reabsorption and then recovers wastes through tubular secretion. At the proximal tubule's narrowest point, it turns back toward the renal corpuscle and widens once more. This is the loop of Henle, which then becomes the distal convoluted tubule. The distal convoluted tubule returns water through tubular reabsorption to the veins and then empties wastes and excess water into a collecting tubule.

5. **The renal corpuscles and the convoluted portions of the renal tubules are located in the renal cortex** (see Figure 4 on the next page).

6. **The loop of Henle and the collecting tubules are located in the renal medulla** (see Figure 4 on the next page).

7. **Urine is formed in the renal corpuscle and in the renal tubule by filtration, reabsorption, and secretion.**

OBJECTIVE 9

Label the major microscopic structures of a nephron (see Figure 4 below).

✓ **NOTE:** Figure 4 shows a simplified view of a nephron. The drawing has been simplified because in reality the capillaries that surround the tubules form a complex network similar to that shown around the loop of Henle. Also, the tubules are convoluted—full of twists and curves. One end of the renal tubule swells into the renal corpuscle.

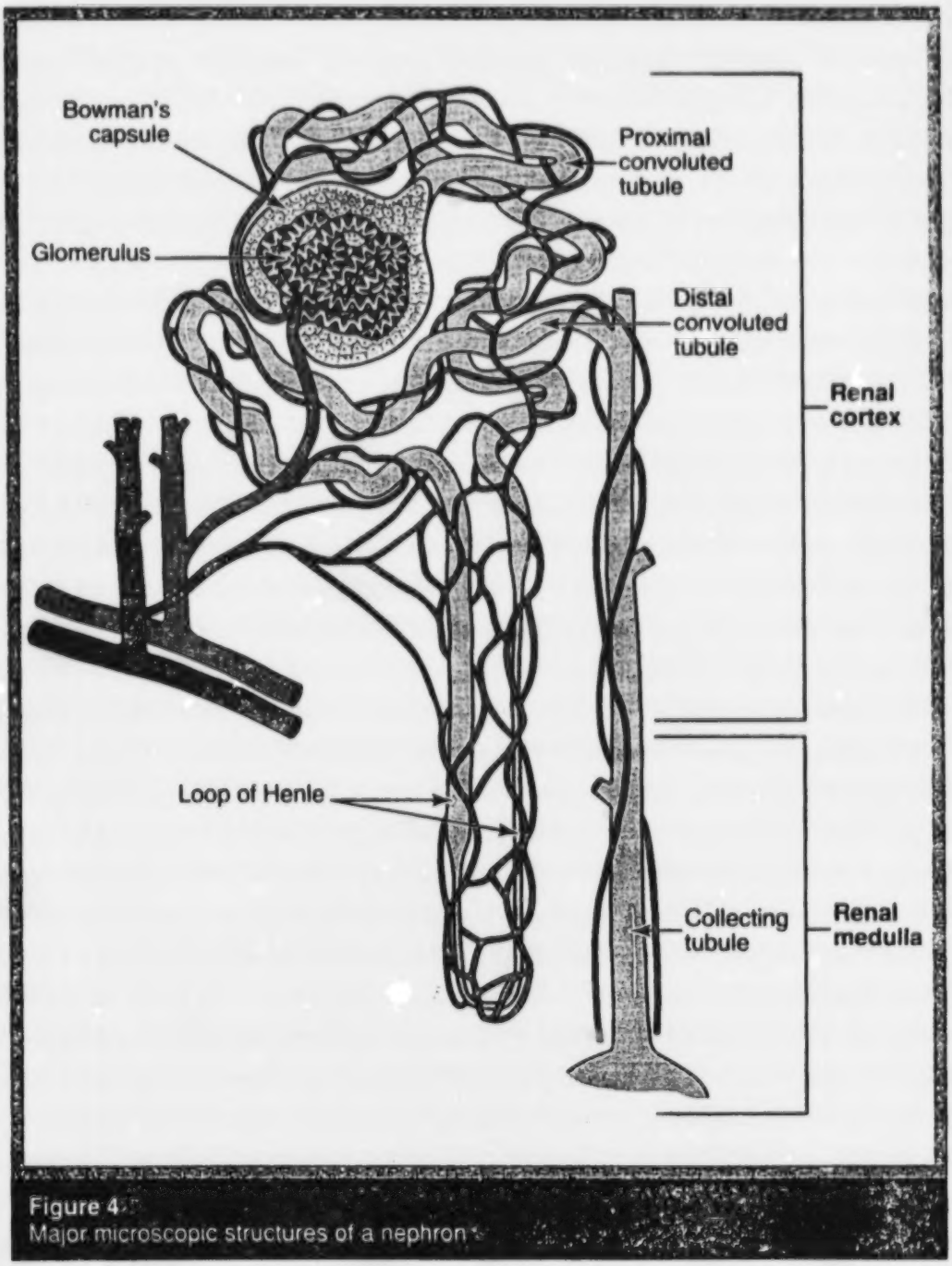


Figure 4
Major microscopic structures of a nephron

OBJECTIVE 10

State functions of the kidneys.

1. **Filter the liquid portion of blood in the distal part of the nephrons**
2. **Manufacture urine**
3. **Excrete urine from the proximal portion of the nephrons**
4. **Influence blood pressure**
5. **Regulate the fluid content of the blood by separating out the constituents of urine from the blood**
6. **Regulate the concentration of the various salts circulating in the blood**
7. **Extract foreign substances from the body, such as toxins, whether formed in the body or taken into the body from the outside**
8. **Regulate osmotic pressure of extracellular fluid**

   ✔ **NOTE:** Osmotic (awz-maw´-tik) pressure is the force that creates a flow of fluid from areas of higher concentration to lower concentration.

9. **Regulate electrolyte and acid-base balance**

   ✔ **NOTE:** By helping to regulate the secretion of electrolytes and the amount of water that is returned to the intercellular spaces, the kidneys help to ensure that the cells are maintained in a balanced pool of fluids that promote proper cell metabolism.

OBJECTIVE 11

Complete statements that describe the characteristics and structure of the ureters.

1. **Each ureter is approximately 10 to 12 inches (250 to 300 millimeters) long and ¼ inch (6.5 millimeters) in diameter.**
2. **The ureters begin as calyces in the renal pelvis and end in the posterior floor of the urinary bladder.**
3. **The ureters consist of three tissue layers: an inner mucous membrane, a middle layer of smooth muscles, and an outer wall of fibrous tissue.**
4. **Urine is carried through the ureters by peristaltic waves of the muscular-tissue layer.**

OBJECTIVE 12

Complete statements that describe the characteristics and structure of the urinary bladder.

1. **The urinary bladder is a hollow, muscular, membranous, collapsible sac located in the pelvis directly behind the symphysis pubis.**

KEY TERM

Symphysis pubis (sim(p)´-fuh-suhs pyu´-buhs)—The slightly movable interpubic joint of the pelvis, consisting of two pubic bones separated by a disc of fibrocartilage and connected by two ligaments

2. **The urinary bladder is held in position by a peritoneal fold or fascia.**

3. **The urinary bladder has rugae to allow it to expand or collapse, depending on how much urine is present.**

4. **The urinary bladder has an average capacity of 18 to 30 cubic inches (300 to 500 cubic centimeters).**

5. **The three openings on the floor of the bladder form a triangle called the *trigone* (tri′-gawn) *area* with a ureter on each side and the urethra in the front** (see Figure 5 below).

6. **Urine is emptied from the bladder through the urethra by contractions of its muscular walls.**

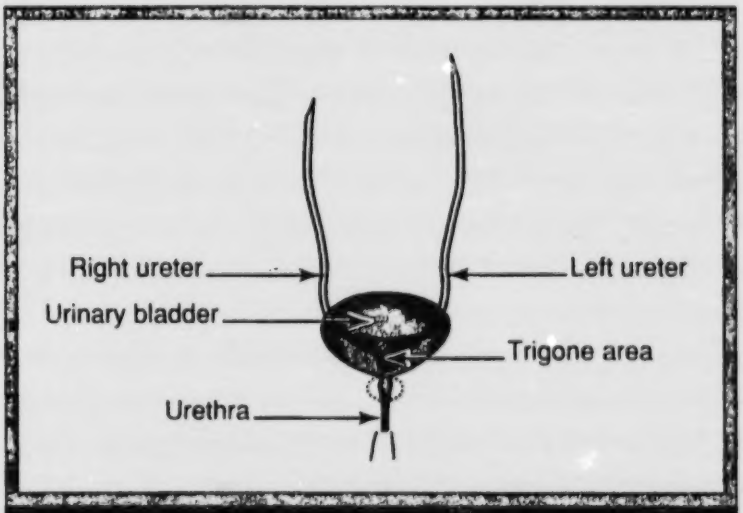


Figure 5
Trigone area of the urinary bladder

OBJECTIVE 13 **Complete statements that describe the characteristics and structure of the female urethra.**

1. **The female urethra is a short tube approximately 1½ inches (40 millimeters) long and ¼ inch (6.5 millimeters) in diameter that lies behind the symphysis pubis and is embedded in the wall of the vagina.**

2. **The urethra acts as a passageway for urine from the urinary bladder to the urinary meatus.**

KEY TERMS

Vagina (vuh-ji′-nuh)—The canal in a female that leads from the uterus to the external opening of the genital canal

Urinary meatus—The external opening of the urethra

3. **The urethra contains an internal and an external sphincter.**

4. **The Skene's glands open into the urethra at its termination to secrete lubricating fluid.**

✔ **NOTE:** During embryonic development, the male and female urogenital systems follow similar developmental paths, as will be explained in Module 14. In the male, the **penis** develops; in the female, a similar nerve-filled erectile structure called the ***clitoris*** forms. The **scrotum** of the male develops as the **labia** in the female. The Skene's glands are equivalent to the male **prostate** gland.

KEY TERMS

Skene's (skenz´) **glands**—The largest glands opening into the urethra of women

Penis (pe-nuhs)—The external reproductive organ of a man that also functions as the channel by which urine leaves the body

Clitoris (kli´-tuh-ruhs)—The vaginal erectile structure

Scrotum (skro´-tuhm)—The external pouch that contains the testes

Labia (la´-be-uh)—The folds at the margin of the vulva

Prostate (praws´-tat)—The firm, partly muscular, partly glandular body located at the base of the male urethra that produces a secretion that liquifies coagulated semen

OBJECTIVE 14 **Complete statements that describe the characteristics and structure of the male urethra.**

1. **The male urethra acts as a passageway for both urine and seminal fluid.**

2. **The male urethra is a modified S-shaped tube approximately 8 to 10 inches (200 to 250 millimeters) long that consists of three divisions: the prostatic** (praw-sta´-tik) **division, the membranous division, and the cavernous division.**

3. **After exiting the bladder from below, the prostatic division passes through the center of the prostate gland.**

4. **The membranous division extends from the apex of the prostate and the bulb of the urethra between two sheets of white fibrous tissue that connect the pubic bones and is surrounded by the external sphincter muscle.**

5. **The cavernous (anterior) division extends from the pelvic walls through the penis to the urinary meatus.**

OBJECTIVE 15 **Complete statements that describe the normal physical characteristics of urine.**

1. **Urine is a clear, straw-colored watery solution containing the waste products of metabolism.**

2. **Urine is straw-colored as a result of the excreted bile pigments it contains.**

3. **Urine has an average pH of 6.0, with a normal range of 5.5 to 6.5 and is, thus, slightly acidic.**

   ✔ **NOTE:** Recall that pH is a scale of acidity from 0 to 14 with 7 being the neutral point and higher acidity described as the value progresses toward 0.

4. **Urine is slightly heavier than water, with a specific gravity of 1.015 to 1.025.**

5. **The amount of urine excreted is dependent on the amount of fluid intake and the amount of fluid lost through other mechanisms, such as respiration and perspiration; on the average, a person will excrete 61 to 110 cubic inches (1000 to 1800 cubic centimeters) of urine per 24-hour period.**

6. **After standing for a short period of time, urine has the characteristic odor of ammonia.**

7. **The normal constituents of urine are water, organic substances, and inorganic substances.**

8. **Normal urine is approximately 95 percent water.**

9. **The organic substances in urine are largely protein waste products, including uric acid, urea, creatinine, ammonia, and hormones.**

KEY TERM

Creatinine (kre-a´-tuhn-en)—The by-product of cellular respiration formed from creatine phosphate

10. **The inorganic substances are primarily mineral salts, and include sodium chloride, sulfates, phosphates, potassium, magnesium, and calcium.**

OBJECTIVE 16 **Complete statements that describe the processes for producing and expelling urine.**

1. **Blood carrying wastes flows into the kidneys.**

2. **The high blood pressure within the glomeruli forces blood plasma into the Bowman's capsules to filter it, producing a fluid called *renal filtrate*** (fil´-trat).

3. **Nutrients, water, and minerals are reabsorbed from the filtrate and into the bloodstream of the peritubular** (per-uh-tu´-byuh-luhr) **capillaries.**

4. **The capillaries secrete additional wastes and hydrogen into the filtrate.**

5. **Hormones influence the amount of water that is reabsorbed to help maintain normal blood volume and pressure.**

6. **The waste products in the filtrate are carried from the body in excreted urine.**

7. **The process of expelling urine is variously known as *urination*, *voiding*, or *micturition*** (mik-chuh-ri´-shuhn).

8. **For an average person, as the volume of urine in the bladder approaches 12 to 15 cubic inches (200 to 250 cubic centimeters), the pressure of bladder expansion creates an impulse in the central nervous system indicating a need to urinate.**

9. **Although urination is dependent on involuntary reflexes, humans learn partial voluntary control over urinating.**

10. **Expulsion of urine from the bladder is accomplished by contracting the walls of the bladder and relaxation of the sphincter muscles at the junction of the urinary bladder and the urethra.**

11. **The external sphincter of the urethra controls the release of urine.**

12. **The inability to control urination, called *incontinence*** (in-kawn´-tuhn-uhn{t}s), **occurs in young children until control is learned and in the elderly in whom the sphincter has weakened.**

OBJECTIVE 17 **List the common abnormal constituents of urine.**

✔ **NOTE:** Urinalysis (yur-uh-na´-luh-suhs)—testing urine to determine its chemical makeup—is a widely practiced medical procedure that can be useful in determining systemic health problems. The presence of certain substances in a urine sample may indicate a medical disorder, such as the body's inability to use certain nutrients or the production of too much of a substance within the body.

1. **Glucose**

   ✔ **NOTE:** The presence of glucose in the urine is generally a sign that an insulin-related problem exists. The condition is called *glycosuria* (gli-ko-shur´-e-uh) (see Objective 19).

2. **Albumin**

   ✔ **NOTE:** The presence of albumin and other proteins is an indication that proteins are passing through the glomerular capsules. The condition is referred to a *proteinuria* pro-tuhn-ur´-e-uh) (see Objective 19).

3. **Blood**

   ✔ **NOTE:** Blood in the urine is called *hematuria* (he-muh-tur´-e-uh) (see Objective 19).

4. **Pus cells**

   ✔ **NOTE:** Pus cells are a sign of infection within the urinary tract. The condition is sometimes generally referred to as *bacteriuria* (bak-tir-e-yur´-e-uh) (see Objective 19), as a symptom of infection by the specific organism. For example, bacteriuria may be a symptom of various types of various sexually transmitted diseases. The condition usually results in urine that is cloudy rather than clear.

5. **Acetone**

✔ **NOTE:** Acetone is one of a number of acidic ketones that may be found in urine in a condition called *ketonuria* (ke-to-nur´-e-uh) (see Objective 19).

OBJECTIVE 18 **Complete statements that describe the characteristics of calculi in the urinary tract.**

1. **Calculi may form in the kidneys or any other part of the urinary tract.**
2. **Because they contain calcium, calculi are usually radiopaque.**
3. **Calculi usually form as a result of excessive amounts of calcium, sodium, or other mineral salts; a decrease in the amount of water; or excessively acidic or alkaline urine.**

KEY TERMS

Calculus (kal´-kyuh-luhs; *plural*, kal´-kyuh-li)—A particle found in the kidney or urinary tract that forms as a result of mineral deposits, generally of salts formed from ingested materials; also called *kidney stones*

Radiopaque (ra-de-o-pak´)—Referring to a substance that is capable of reducing the amount of x-ray energy that passes through it, thus making it visible in a radiograph

OBJECTIVE 19 **Define common disorders and abnormalities of the urinary system.**

1. **Glycosuria**—The abnormal presence of a sugar—especially glucose—in the urine

✔ **NOTE:** Glycosuria can result from eating large amounts of carbohydrates, or it may be the result of endocrine or renal disorders, and it is associated with diabetes mellitus.

2. **Proteinuria**—The presence in the urine of abnormally large quantities of protein, usually albumin

✔ **NOTE:** Persistent proteinuria is usually a sign of renal disease or complications of another disease, such as hypertension or heart failure.

3. **Hematuria**—The abnormal presence of blood in the urine

✔ **NOTE:** Hematuria is a symptom of many renal diseases and disorders of the urinary system.

4. **Bacteriuria**—The presence of bacteria in the urine

✔ **NOTE:** The presence of more than 100,000 pathogenic bacteria per $\frac{5}{100}$ cubic inch (1 milliliter) of urine is usually considered significant enough to diagnose a urinary-tract infection.

5. **Pyuria** (pi-yur´-e-uh)—The presence of white blood cells in the urine, which is usually a sign of infection in the urinary tract

   ✔ **NOTE:** Excessive white blood cells suggest a bacterial or other infection. A bacterial pyuria usually is caused by viral infection of the bladder and urethra.

6. **Ketonuria**—The presence in the urine of excessive amounts of ketone bodies

   ✔ **NOTE:** Ketones are normally found in the urine as a by-product of the metabolism of fats and proteins. However, elevated levels of ketones may indicate diabetes mellitus. The condition can also occur during extremes of diet, such as a high-protein diet or the later stages of starvation.

7. **Gout** (gaut´)—A metabolic disease that increases the production of or interferes with the excretion of uric acid, resulting in deposits of uric acid in the blood

   ✔ **NOTE:** Men are more often affected by gout than women. The great toe is a common site for the accumulation of urate crystals. The condition can result in painful swelling of a joint, accompanied by chills and fever.

8. **Cystitis** (sis-ti´-tuhs)—An inflammation of the urinary bladder and ureters that is characterized by pain, by urgency and frequency of urination, and by hematuria

   ✔ **NOTE:** Cystitis may be caused by a bacterial infection, calculus, or tumor.

9. **Nephritis** (ni-fri´-tuhs)—An inflammation of the kidneys

   ✔ **NOTE:** Nephritis can be caused by any one of a large group of diseases of the kidney.

10. **Urethritis** (yur-i-thri´-tuhs)—An inflammation of the urethra

    ✔ **NOTE:** Urethritis is usually the result of an infection in the bladder or kidneys.

11. **Dysuria** (dis-yur´-e-uh)—Painful urination that is usually the result of a bacterial infection or obstruction in the urinary tract

    ✔ **NOTE:** A person with dysuria usually complains of a burning sensation when passing urine.

12. **Polyuria** (paw-le-yur´-e-uh)—The excretion of an abnormally large quantity of urine

    ✔ **NOTE:** Two causes of polyuria are diabetes and excessive fluid intake.

13. **Oliguria** (aw-li-gur´-e-uh)—The diminished capacity to form and pass urine

    ✔ **NOTE:** Excreting less than 1 pint (500 milliliters) in every 24 hours—oliguria—is usually caused by imbalances in body fluids and electrolytes, by renal lesions, or by urinary-tract obstruction.

14. **Urethral stricture**—A narrowing of the urethra

15. **Urinary incontinence**—The inability to control urination; involuntary urination

✔ **NOTE:** Urinary incontinence may be caused by aging, infection, lesions in the brain or spinal cord, damage of the peripheral nerves of the bladder, or injury to the sphincter or perineal structures.

16. **Urinary retention** (ri-ten{t}´-shuhn)—The inability to completely empty the urinary bladder when it is full

✔ **NOTE:** The characteristics of urinary retention are bladder distention and small, infrequent voiding or the absence of urine output.

17. **Urinary suppression** (suh-pre´-shuhn)—The inability to void because the kidneys are not secreting any urine and the bladder is empty

18. **Renal** ptosis—The shifting of a kidney, usually to a lower position in the pelvis

✔ **NOTE:** Renal ptosis is usually asymptomatic, but pregnancy may result in obstruction of the flow of urine from the kidney.

KEY TERM

Ptosis (to´-suhs)—A falling, dropping, or prolapse of an organ

19. **Renal failure**—The inability of the kidneys to function properly—excrete wastes, concentrate urine, and conserve electrolytes

✔ **NOTE:** Renal failure will lead to death unless artificial hemodialysis (he-mo-di-a´-luh-suhs) is used. In the process of hemodialysis, a machine is used to remove blood from an artery, purifying it, adding vital substances, and returning it to a vein.

OBJECTIVE 20

Assignment Sheet 1—Practice Critical Thinking: Investigate Treatment Options for End-Stage Renal Disease

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

Patients who have serious problems and disorders of the kidneys are likely to have to make a decision one day about their treatment. Many will begin by getting kidney dialysis. In this procedure, a machine is used to perform those functions normally done by the kidneys. Patients often must go to a dialysis center two or three times per week for a procedure that lasts several hours. Generally, the patients are left physically exhausted.

Continuing deterioration of the kidneys will eventually lead to a condition referred to as *end-stage renal disease* (ESRD). At this point, dialysis is essential but increasingly impractical. The effectiveness of the procedure and the person's stamina to deal with the process steadily decrease. At some point, the patient will have to seriously consider the need for a kidney transplant if life is to continue.

Kidney transplants are unlike most other organ transplants in that the organ can be harvested from a living donor. The fact that we have two kidneys but can survive with one functioning kidney means that it is possible for a person to make a gift of a kidney to someone who needs it. Generally, only a close relative or very good friend is willing to make that kind of sacrifice; consequently, the decision and act can be emotionally wrought for both the donor and the recipient.

In this assignment sheet, you will evaluate treatment options for ESRD and make recommendations for the procedures that you think best fit the situation. However, to give you a greater sense of what the evaluation truly entails and to deal with the variables that are likely to occur in such a case, you will assume the role of either the donor or the recipient. Your instructor will assign you one role. Your instructor may pair you with someone in the class who will serve in the other role, or you may be asked to think of a relative in that role as your donor or a recipient of the kidney that you will donate.

To help you prepare for this exercise, you need to learn more about kidney transplants. Your instructor may provide you with information and resources or you may want to visit the web sites* listed below that will provide you with information about the decisions you will be asked to make.

- http://www.kidneytransplant.org/realaudio/leftdonornephrectomy.ram

  This site includes a digital video showing the laparoscopic procedure used to remove a kidney from a donor. The next two pages listed are on the same site and provide information about the two common types of procedures used in kidney transplants. Conventional surgery is used for the recipient and can be used for the donor. Laparoscopic surgery can be used to remove the donor kidney. Both pages offer information about patient requirements, risks, complications, and other considerations that should go into making the decision.

  http://www.kidneytransplant.org/conventionalsurgery.html

  http://www.kidneytransplant.org/laparoscopicsurgery.html

- http://www.kidney.org/
  http://www.renalnet.org/renalnet/renalnet.cfm

  These two sites provide information about kidneys and diseases as well as material on transplants. They also offer links to sites dealing with kidney transplants.

- http://www.emory.org/transplant/reframe.cgi?dest=/transplant/proinfo/kidney/info.cgi

  This site provides a great deal of information about kidney transplants.

- http://www.vstream.com/basic/providers/umd/042199donor/28.asx

  This site is essential in doing this assignment sheet. In the video program that it contains, doctors and other health professionals explain the transplant procedures and related facts. The program also contains interviews with kidney transplant donors and recipients.

*Web-site addresses were accurate and all content on referenced web sites was appropriate during development and production of this product. However, web sites sometimes change; MAVCC takes no responsibility for a site's content. The inclusion of a web site does not constitute an endorsement of that site's other pages, products, or owners. You are encouraged to verify all web sites prior to use.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Review the web sites listed above.

_____ 3. Read the investigation points for the donor and the investigation points for the recipient on the following pages.

_____ 4. Check with your instructor to determine which role you will assume—donor or recipient. Describe that role on the blank lines provided below.

_____ 5. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided below.

_____ 6. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 7. Complete your investigation and give your investigative report to your instructor for evaluation.

Role you will assume _____

Format of investigative report _____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

Investigation points for the role of the donor

INVESTIGATION POINT 1 Describe the reservations you would have in donating a kidney.

INVESTIGATION POINT 2 Describe the factors that would lead you to donate a kidney.

INVESTIGATION POINT 3 If you were to donate a kidney, which removal procedure—conventional or laparoscopic—would you choose? Explain why you would choose this procedure.

INVESTIGATION POINT 4 Describe the risks and complications you would face, based on your actual health and lifestyle.

INVESTIGATION POINT 5	Based on what you have learned about kidney transplants, explain why you could or could not actually donate a kidney to a parent or sibling if he or she needed one.
	Investigation points for the role of the recipient
INVESTIGATION POINT 1	Explain the advantages and disadvantages of continuing dialysis instead of getting a transplant.
INVESTIGATION POINT 2	Explain the advantages and disadvantages of getting a transplant.
INVESTIGATION POINT 3	Describe the factors in your lifestyle that would make you a good risk for a transplant. Describe the lifestyle changes you would have to make to improve your prospects as a recipient.
INVESTIGATION POINT 4	Describe how you would go about choosing a donor and what reservations you might have about asking someone to donate a kidney. From the people you know, describe the person who would be the best choice for a donor.
INVESTIGATION POINT 5	Describe the criteria (potential complications, survival rates, etc.) you would use in choosing a hospital and surgical staff to perform the procedure. Describe the role the donor would have in selecting a hospital and surgical staff.

MODULE SET II:
Major Body Systems

Module 14: Reproductive System—Male

1369

Module Contents

COMPONENTS

	Page
Learning Activities Sheet	3
Module Objective Sheet	5
Information Sheet	7
Assignment Sheet	
1—Practice Critical Thinking: Investigate a Topic Related to Male Sexual Dysfunction	19

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 15.
- ❑ 5. **Research** Online resources to learn more about the male reproductive system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Investigate a Topic Related to Male Sexual Dysfunction."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** With your instructor for any additional assignments to be completed.

❑ 11.	**Do**	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	**Take**	Module Review provided by your instructor.
❑ 13.	**Stop**	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major glands and structures of the male reproductive system, state the function of the male reproductive system, and define common disorders and abnormalities of the male reproductive system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *male reproductive system.*
2. State the functions of the male reproductive system.
3. Define the term *semen.*
4. Define the major glands and structures of the male reproductive system.
5. Label the major glands and structures of the male reproductive system.
6. Complete statements that describe the characteristics and structure of the scrotum.
7. Complete statements that describe the characteristics and structure of the testes.
8. Complete statements that describe the characteristics and structure of the epididymis.
9. Complete statements that describe the characteristics and structure of the vas deferens.
10. Complete statements that describe the characteristics and structure of the seminal vesicles.
11. Complete statements that describe the characteristics and structure of the prostate gland.
12. Complete statements that describe the characteristics and structure of the bulbourethral glands.
13. Complete statements that describe the characteristics and structure of the penis.
14. Describe the stages of development of the male reproductive organs.
15. Match common disorders and abnormalities of the male reproductive system to their correct definitions.
16. Practice critical thinking: investigate a topic related to male sexual dysfunction. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *male reproductive system*.

- **Male reproductive system**—The male gonads, associated ducts and glands, and the external genitalia that function in the procreation of offspring (see Figure 1 below)

KEY TERMS

Male gonad (go´-nad)—The reproductive gland in a male that produces **gametes**; a testis

✔ **NOTE:** You will study the testes in Objective 7.

Gamete (ga´-met)—A mature male or female germ cell; the spermatozoon in a male (see Objective 3)

Genitalia (je-nuh-tal´-yuh)—The organs of the reproductive system and the associated structures of either sex

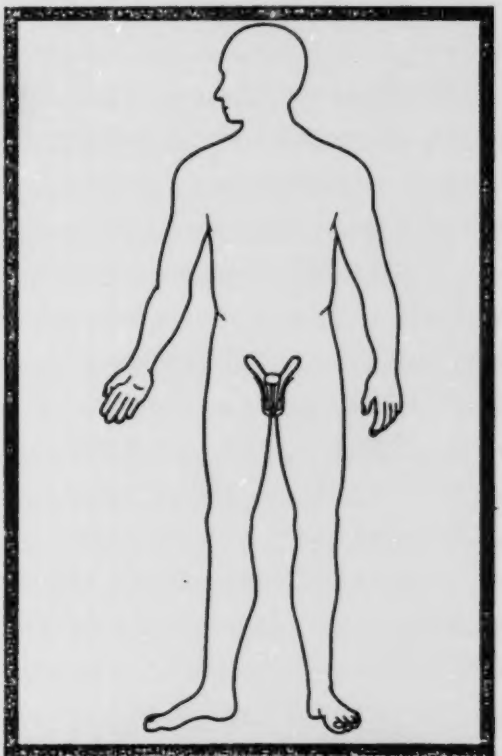


Figure 1
Male reproductive system

OBJECTIVE 2 **State the functions of the male reproductive system.**

1. **Perpetuation of the human species**

✔ **NOTE:** The basic purpose of the reproductive system is to provide a means of continuing human life. Eventually, the body will die, and with its end, the traits that have been developed and learned through living will be lost. Through reproduction, a new individual is created, bearing characteristics of both parents and embedded knowledge or instincts of the species. In this way, the species continues and advances—it perpetuates—even though individuals die.

2. **Sexual gratification**

✔ **NOTE:** Higher animals are instinctually driven to mate with other members of their species. The processes that lead to sexual excitement are a powerful force that prepare the individual emotionally and physically to have **intercourse**. The path to **sexual arousal** comes through the senses. In lower animals, females in heat or **estrus** often manifest visible signs, such as swollen genitals or behavior patterns. They may exude a scent, make certain sounds, or make contact with the male. Humans have equivalent sexual signals, from the way we dress to perfumes and colognes to sexually arousing talk to stimulation of **erogenous zones**. The act of intercourse itself can lead to sexual **climax**, which in turn satisfies the urges that led to the act—at least temporarily.

KEY TERMS

Intercourse (in´-tuhr-kors)—Sexual union; the sexual mating of a male and female

Sexual arousal (uh-rauz´-uhl)—Sexual excitement as a result of mental, visual, or tactile stimulation

Estrus (es´-truhs)—The condition of a female mammal in which she is sexually excited, will accept a mate, and is capable of becoming pregnant

Erogenous (i-raw´-juh-nuhs) **zones**—Areas of the body that are sensitive to sexual stimulation

Climax (kli´-maks)—The peak of sexual excitement, accompanied by near convulsive physical and emotional responses, including **ejaculation** in the male

Ejaculation (i-ja-kyuh-la´-shuhn)—The sudden emission of semen from the male urethra

✔ **NOTE:** See Objective 3 for the definition of the term *semen*.

3. **Secretion of hormones**

✔ **NOTE:** A person's sexual characteristics and sexual drive are produced by chemicals within the body. These hormones lead to the development of **secondary sex characteristics** in an individual, such as body hair, enlarged breasts in a woman, and a masculine build in a man. Further, these hormones help to fuel sexual drive and, in a pregnant woman, the development of the fetus and urges to care for the child.

KEY TERM

Secondary sex characteristics—Characteristics of the male that include (1) an increase in the size of the larynx, resulting in a lower pitch of the voice; (2) rapid growth of external genitalia; (3) development of hair on the face, pubis, axilla, and other parts of the body; and (4) development of firmer musculature, broad shoulders, and narrow hips

✔ **NOTE:** With the onset of puberty, the body changes chemically. Through the secretion of hormones, changes in the appearance and functioning of the body take place. The ability to bear children in the woman and the ability to sire children in a male are primary sexual characteristics—they are directly related to reproduction. However, other changes also take place that are not related to reproduction. For example, in the male, the development of firmer musculature and broad shoulders makes the male more attractive to females and, in earlier times, made the male a more desirable partner for mating. These mature males were able to select mates and fight off other males who were weaker due to youth or old age.

OBJECTIVE 3 **Define the term *semen*.**

■ **Semen** (se´-muhn)—Seminal fluid; the thick, sticky, whitish fluid of the male reproductive system that is discharged from the urethra on ejaculation and contains **spermatozoa** suspended in the secretions of the glands associated with the reproductive system

✔ **NOTE:** Seven/one-hundredths cubic inch (1 cubic centimeter) of semen contains approximately 70 to 100 million sperm, and the average ejaculation contains 3/10 to 5/10 cubic inch (3 to 5 cubic centimeters).

KEY TERM

Spermatozoon (spuhr-ma-tuh-zo´-uhn)—A mature male germ cell that develops in the testes and resembles a tadpole with a head containing a nucleus, a neck, and a tail that provides propulsion (see Figure 2 below)

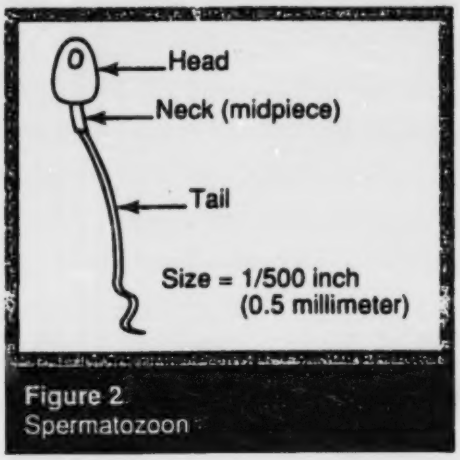


Figure 2
Spermatozoon

OBJECTIVE 4

Define the major glands and structures of the male reproductive system (see Figure 3 on the next page).

1. **Scrotum** (skro´-tuhm)—The pouch of skin that contains the testes

   ✔ **NOTE:** You will study more about the scrotum in Objective 6.

2. **Testis** (tes´-tuhs)—One of a pair of male reproductive glands that produces sperm and is contained within the scrotum at sexual maturity

   ✔ **NOTE:** The plural of testis is testes (tes´-tez). You will study more about the testes in Objective 7.

3. **Epididymis** (e-puh-di´-duh-muhs)—A system of **ductules** emerging posteriorly from the testis that holds sperm and that unites into a single coiled duct that is continuous with the vas deferens

   ✔ **NOTE:** You will study more about the epididymis in Objective 8.

KEY TERM

Ductule (duhk´-chul)—A small duct

4. **Vas deferens** (vas´ de´-fuh-ruhnz)—The thick-walled spermatic duct that begins at and is continuous with the tail of the epididymis and eventually joins the duct of a seminal vesicle to form the ejaculatory duct

   ✔ **NOTE:** You will study more about the vas deferens in Objective 9.

5. **Seminal vesicle** (se-muh-nuhl ve´-si-kuhl)—Either of a pair of glandular pouches that lie on either side of the male reproductive tract and secrete a sugar- and protein-containing fluid into the ejaculatory duct

   ✔ **NOTE:** The fluid produced by the seminal vesicles is added to the secretion of the testes and other glands to form semen. You will learn more about the seminal vesicles in Objective 10.

6. **Ejaculatory** (i-ja´-kyuh-luh-tor-e) **duct**—Either of the paired ducts that are formed by the junction of the duct from the seminal vesicle with the vas deferens and that pass through the prostate to empty into the urethra by means of a small opening

7. **Prostate** (praws´-tat) **gland**—The chestnut-sized gland in men that surrounds the neck of the bladder and the urethra and produces a secretion that liquifies coagulated semen

   ✔ **NOTE:** You will study more about the prostate gland in Objective 11.

8. **Bulbourethral** (buhl-bo-yu-re´-thruhl) **gland** (Cowper's gland)—Either of two small, pea-shaped glands located below the prostate gland and connecting with the urethra and discharging a fluid into the semen that is necessary for sperm viability

   ✔ **NOTE:** You will study more about the bulbourethral glands in Objective 12.

9. **Urethra** (yu´-re-thruh)—The tubular structure that in men serves as a passageway for semen during ejaculation and as a canal for urine during voiding

10. **Penis** (pe´-nuhs)—The external reproductive organ of a man

✔ **NOTE:** You will study more about the penis in Objective 13.

11. **Glans penis**—The cone-shaped tip of the penis that is composed of erectile tissue, encloses the urethra, and contains the urethral orifice, which is also called the *urinary meatus*

12. **Prepuce** (pre´-pyus)—The foreskin; the fold of skin that forms the retractable cover of the glans penis

OBJECTIVE 5 **Label the major glands and structures of the male reproductive system** (see Figure 3).

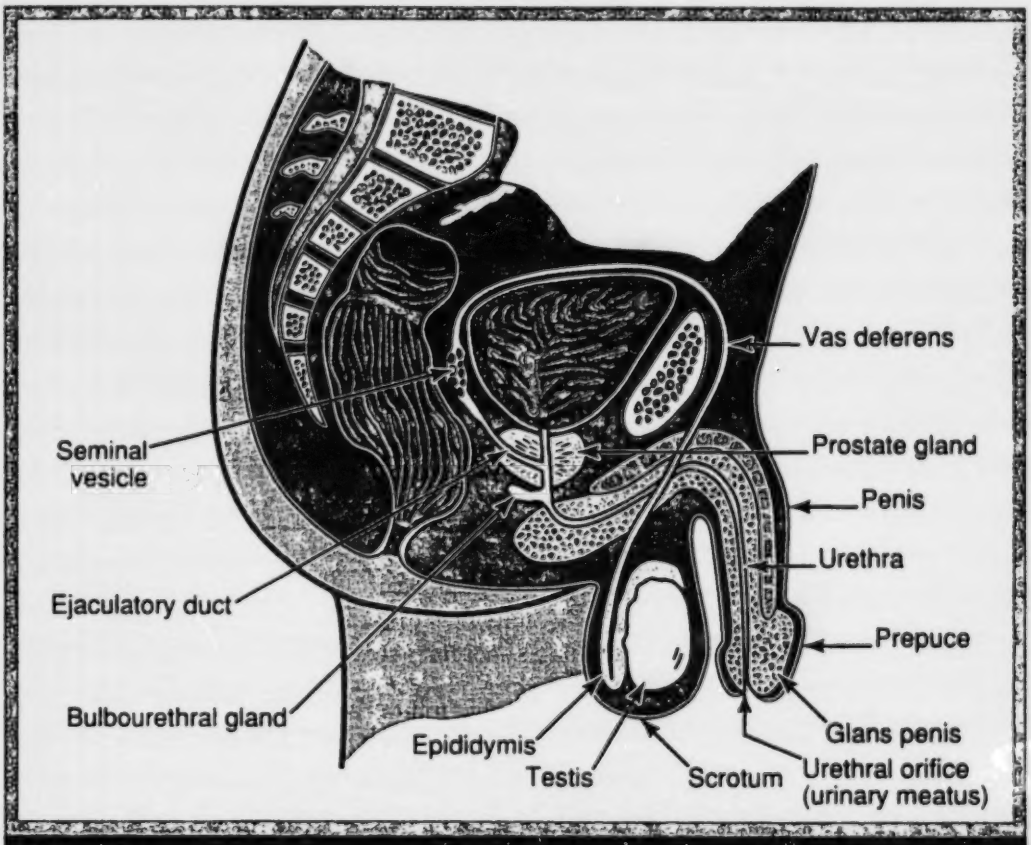


Figure 3
Major glands and structures of the male reproductive system

OBJECTIVE 6

Complete statements that describe the characteristics and structure of the scrotum.

1. **The scrotum is suspended from the perineal region; and the tissues of the scrotum are continuous with those of the groin and perineum.**
2. **The scrotum is divided by an internal septum that creates a sac for each testis.**
3. **The location of the scrotum helps to maintain an environmental temperature that is favorable for sperm production.**

✔ **NOTE:** The testes are normally outside the pelvic cavity, suspended in the scrotum. The internal body temperature is actually destructive to **spermatocytes**, thus the scrotum is an external sac. However, spermatocytes can also be damaged by extreme cold, which explains why the testes may be drawn up into the pelvic region when exposed to cold temperatures.

KEY TERM

Spermatocyte (spuhr-ma´-tuh-sit)—An immature sperm cell

OBJECTIVE 7

Complete statements that describe the characteristics and structure of the testes.

1. **The testes are the primary male reproductive endocrine glands.**
2. **The testes are egg-shaped glands located in the scrotum and suspended from the inguinal region by the spermatic** (spuhr-ma´-tik) **cord.**
3. **The testes produce spermatozoa and secrete them as semen (seminal fluid).**
4. **The testes also secrete the hormones testosterone and androsterone directly into the blood.**

KEY TERMS

Testosterone (te-staws´-tuh-ron)—The male hormone that stimulates the development of the secondary sexual characteristics

Androsterone (an-draws´-tuh-ron)—A male sex hormone found in human male and female urine

OBJECTIVE 8

Complete statements that describe the characteristics and structure of the epididymis.

1. **The epididymis is a single, tightly coiled tube that lies along the sides and superior portion of the testes.**
2. **Though very small in diameter, the epididymis measures approximately 20 feet (7 meters) in length.**

3. **The epididymis connects the testes with the vas deferens and serves as one of the ducts through which sperm travels during ejaculation.**

4. **The epididymis stores sperm as it matures and secretes part of the seminal fluid.**

OBJECTIVE 9

Complete statements that describe the characteristics and structure of the vas deferens.

1. **The vas deferens is approximately 18 inches (900 millimeters) long.**

2. **The vas deferens passes into the abdominal cavity through the inguinal canal, where it is enclosed in the spermatic cord.**

3. **The vas deferens extends over the top of the posterior surface of the urinary bladder and down to the prostate gland, where it joins the corresponding seminal vesicle to form the ejaculatory duct.**

4. **The vas deferens serves as a passageway for sperm.**

✔ **NOTE:** A common surgical procedure is the vasectomy (vuh-sek´-tuh-me) in which the vas deferens are excised to interrupt the seminal pathway. This results in sterility and is used as a form of **contraception**.

KEY TERM

Contraception (kawn-truh-sep´-shuhn)—Conscious efforts to prevent pregnancy

✔ **NOTE:** The act of creating an embryo through sexual intercourse is called *conception*. *Contra-* means *against*. The surest form of contraception is abstinence—not having sexual intercourse. Other contraceptive measures include pharmaceutical means such as "the pill," chemical means such as spermicides, and physical means such as condoms and interuterine devices (IUDs) that are designed to prevent the egg from implanting. There are surgical means such as vasectomy for men or tubal ligation (li-ga´-shuhn) (severing of the fallopian tubes) or hysterectomy (his-tuh-rek´-tuh-me) (removal of the uterus) for women.

OBJECTIVE 10

Complete statements that describe the characteristics and structure of the seminal vesicles.

1. **The seminal vesicles are membranous, hollow pouches that lie obliquely between the bladder and the rectum, posterior to the lower portion of the bladder.**

2. **The seminal vesicles produce secretions that bathe, protect, and nourish spermatozoa.**

3. **The anterior portion of a seminal vesicle converges with a corresponding vas deferens to form an ejaculatory duct.**

OBJECTIVE 11

Complete statements that describe the characteristics and structure of the prostate gland.

1. **The prostate gland is a single, globular gland that lies inferior to the bladder outlet and surrounds the first section of the urethra.**
2. **The prostate is composed of glandular tissue and is covered by a fibrous capsule.**
3. **The prostate secretes a portion of the semen and an alkaline fluid that increases the motility and fertility of the spermatozoa.**

KEY TERMS

Motility (mo-ti´-luh-te)—The ability to move

Fertility (fuhr-ti´-luh-te)—The capacity to reproduce

✔ **NOTE:** Fertility refers essentially to the health of the sperm, whether it is able to penetrate an ovum and set the reproductive process in motion. Motility is a measure of the sperm's ability to move toward the ovum and to overcome the physical and chemical obstacles of the uterine tubes.

4. **The prostate contracts during ejaculation of seminal fluid.**
5. **The prostate is the most-common site for cancer in the male reproductive system.**

OBJECTIVE 12

Complete statements that describe the characteristics and structure of the bulbourethral glands.

1. **The bulbourethral glands are located one on each side of the membranous section of the urethra.**
2. **A duct about 1 inch (25 millimeters) long connects the glands with the membranous portion of the urethra.**
3. **The glands produce an alkaline fluid that provides lubrication for semen and counteracts the acids present in the male urethra and the female vagina.**

OBJECTIVE 13

Complete statements that describe the characteristics and structure of the penis.

1. **The penis is a cylindrical, pendulous organ suspended from the front and sides of the pubic arch.**
2. **The penis contains the urethra and is the male copulatory organ by which male gametes are introduced into the female vagina.**

KEY TERMS

Copulatory (kaw´-puh-luh-tor-e)—Related to sexual intercourse or copulation

Gamete (ga´-met)—A mature male or female germ cell containing the chromosome set capable of initiating the formation of a new person by fusion with the gamete of the opposite sex

3. **The penis is composed of three cylindrical masses of cavernous tissue bound together by fibrous tissue and covered with skin; the two lateral masses of the penis are called the *corpora cavernosa* (kor´-por-uh ka´-vuhr-no-suh) *penis*, while the median mass is called the *corpus cavernosum urethra* because it contains the urethra.**

4. **Erection of the penis is achieved by the venous spaces becoming filled with blood.**

5. **The skin covering the penis is a continuation of that covering the pubis, scrotum, and perineum.**

OBJECTIVE 14 **Describe the stages of development of the male reproductive organs.**

1. **For approximately the first two months of embryonic life, no structural sexual differentiation is evident, though by the end of the third month, the sex of the fetus is clearly distinguishable.**

2. **At birth, the testes contain thousands of spermatocytes.**

3. **From birth until the onset of puberty, the male reproductive organs grow with the rest of the body but are not functional.**

KEY TERM

Puberty (pyu´-buhr-te)—The stage in life for both genders in which the individual becomes sexually mature and capable of reproduction

4. **With the onset of puberty, the male reproductive system begins producing functional spermatozoa and the body exhibits the secondary sex characteristics.**

✔ **NOTE:** Male reproductive organs may remain functional throughout a natural life span.

OBJECTIVE 15

Match common disorders and abnormalities of the male reproductive system to their correct definitions.

✔ **NOTE:** While this module focuses on the male reproductive system, some of the disorders and abnormalities of the male reproductive system are common to both males and females. For example, either sex can be sterile due to the inability to ejaculate viable sperm in a man or to produce and implant viable ova in a woman. Similarly, the sexually transmitted diseases (STD) listed here may afflict both men and women, though in different ways.

1. **Sterility** (stuh-ri´-luh-te)—The inability to reproduce

   ✔ **NOTE:** A number of factors can lead to sterility in either sex, including injury, disease, birth defects, and psychological or emotional problems. For women, sterility comes with age as the body stops ovulating. A man may be fertile through a normal lifespan, though sexual drive and sperm count may decline with age. The general causes of sterility in a man are the inability to produce spermatozoa, the inability to produce spermatozoa that are fertile and motile, or the inability to produce sufficient numbers of sperm to allow a high probability of fertilization. If a man's production of viable sperm is adequate, then sterility is likely to be the result of a problem that prevents the semen from reaching the urinary meatus. This may be actual damage to the reproductive system or it may be functional sterility, such as the inability to achieve an erection.

2. **Oligospermia** (aw-li-go-spuhr´-me-uh)—Low sperm count

   ✔ **NOTE:** The process of fertilizing an egg is explained in more detail in the next module. However, a substantial part of the process involves the ability of a sperm to reach a fertile egg. A number of barriers stand in the way of that happening. The sperm essentially have to "swim" to the egg and penetrate it within the three days that the sperm is viable and the one day that the egg is capable of conception. Generally less than 1 spermatozoon in every 3 to 5 million will survive to reach the ovum. Thus, with a normal sperm count of 300 to 500 million per ejaculation, as few as 100 to 150 sperm would have a chance of reaching the egg. If a man's sperm count is low, then even fewer spermatozoa have a chance to fertilize the ovum. The man is not sterile, but the chances of fertilization are very low. Some authorities place the level of functional sterility as anything less than 50 million sperm per 5/100 cubic inch (1 cubic centimeter).

3. **Impotence** (im´-puh-tuhn{t}s)—The inability to achieve or maintain an erection to the point of ejaculation

   ✔ **NOTE:** Impotence is a complex condition that may have a number of causes, both physiological and emotional. The male erection is achieved through dilation of the arteries in the penis. Obviously, the failure of the circulatory system or nervous system to support this response can lead to impotence. Inadequate secretion of male sex hormones can contribute. Injury, disease, malnutrition, exhaustion, physical condition, and other factors may make an erection physiologically impossible. A person's self-image, feelings toward a sexual partner or the sexual act, anxiety about sexual performance, stress, distractions, and other mental and emotional factors may lead to impotence. Note that impotence is not simply the inability to attain an erection but also includes the inability to achieve male orgasm, which includes ejaculation.

4. **Epididymitis** (e-puh-di-duh-mi´-tuhs)—Acute or chronic inflammation of the epididymis

   ✔ **NOTE:** Epididymitis may result from venereal disease, urinary-tract infection, or other conditions. Symptoms include fever, chills, pain in the groin, and tender, swollen epididymis.

5. **Prostatic hypertrophy** (hi-puhr´-truh-fe)—Enlargement of the prostate gland

   ✔ **NOTE:** An enlargement of the prostate may be benign, often occurring as a natural part of the aging process. In other cases, it may be an indication of cancer, infection, or other disorder. Because the urethra passes through the prostate, pain or difficulty may accompany urination.

6. **Prostate cancer**—Cancer of the prostate gland

   ✔ **NOTE:** After lung cancer, prostate cancer is the most-common cancer among men in North America.

7. **Testicular** (tes-ti´-kyuh-luhr) **cancer**—Cancer of the testes

8. **Cryptorchidism** (krip-tor´-kuh-di-zuhm)—A birth defect characterized by the testes failing to descend into the scrotum

   ✔ **NOTE:** Cryptorchidism is easy to diagnose and can be repaired with fairly simple surgical procedures. However, it is important that the repair be made right away. The main reason that the scrotum is external to the torso is that the spermatocytes can be killed by excessive heat, including prolonged exposure to internal body temperatures, which would render the individual permanently sterile. Also, research indicates a higher incidence of testicular cancer in individuals who exhibit cryptorchidism, and early correction may lessen the probability of contracting testicular cancer.

9. **Phimosis** (fi-mo´-suhs)—Tightness of the prepuce of the penis that prevents the retraction of the foreskin over the glans penis

   ✔ **NOTE:** Phimosis is usually congenital but may be the result of infection. **Circumcision** is the usual treatment.

KEY TERM

Circumcision (suhr-kuhm-si´-zhuhn)—A surgical procedure in which the prepuce of the penis is excised

10. **Hypospadias** (hi-puh-spa´-de-uhs)—A birth defect in which the urinary meatus is located on the underside of the penis

    ✔ **NOTE:** A similar though rarer condition exhibits the urinary meatus on the dorsal or topside of the penis. This condition is referred to as *epispadias* (e-puh-spa´-de-uhs). Both conditions can be corrected surgically.

11. **Hydrocele** (hi´-druh-sel)—Swelling of the scrotum caused by structural abnormalities at birth or an accumulation of serous fluid in adults

12. **Gonorrhea** (gaw-nuh-re´-uh)—A sexually transmitted disease caused by the bacterium *Neisseria gonorrhoeae* and characterized in men by **urethritis** and pus in the urine, while often being asymptomatic in women

KEY TERM

Urethritis (yur-i-thri´-tuhs)—Inflammation of the urethra

13. **Syphilis** (si´-fuh-luhs)—A sexually transmitted disease caused by the bacterium *Treponema pallidum* that is curable with penicillin but which can lead to serious and even fatal damage to the heart and nerves if not treated

14. **Genital herpes** (huhr´-pez)—A sexually transmitted disease caused by the virus Herpes simplex and characterized by painful lesions

15. **Chlamydial** (kluh-mi´-de-uhl) **infection**—A sexually transmitted disease caused by the bacterium *Chlamydia trachomatis*; in men, the disease is characterized by urethritis or epididymitis while in women it may be asymptomatic or characterized by pelvic inflammation

✔ **NOTE:** Chlamydial infection is now the most common STD in the United States, with approximately 4 million new cases per year—twice the rate of genital herpes. The problem is complicated because women often do not show symptoms in the early stages, and men (who generally develop urethritis) may not seek medical attention with early symptoms. Infants born to infected women are likely to contract the infection and may develop conjunctivitis or pneumonia. The condition can be successfully treated with antibiotics.

OBJECTIVE 16

Assignment Sheet 1—Practice Critical Thinking: Investigate a Topic Related to Male Sexual Dysfunction

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

In recent years, male reproductive-system disorders have gained more public exposure. One-time presidential candidate Bob Dole has become a spokesperson about erectile dysfunction, the sales promotion for sildenafil (sold under the tradename Viagra) floods the public media, cyclist Lance Armstrong's bout with testicular cancer has been well documented, and all about us are stories and advertisements that tell of various disorders and illnesses that can affect male fertility and sexual performance. Others claim that herbs can counteract many of these problems. The existence of sperm banks makes it possible for women to become pregnant without having intercourse with—or even meeting—the father. Some futurists are saying that advances in cloning will soon bring about a day when men are not even necessary for continued propagation of the species.

Some of the information that floods us with regard to male sexual dysfunction is important and some of it is just hype. As a medical professional, you will be expected to know the difference. In fact, people will ask for your advice in both the professional setting and in your personal relationships. In this assignment sheet, you will be given an opportunity to study an aspect of male sexual dysfunction and assess it medically.

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the objectives in the Information Sheet.

_____ 2. Check with your instructor to determine the topic of your investigative report. List your topic on the blanks provided below.

_____ 3. Read the investigation points below and on the next page. Your investigative report must include answers to all eight of these investigation points.

_____ 4. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided below.

_____ 5. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 6. Complete your investigation and give your investigative report to your instructor for evaluation.

Topic of investigative report _____

_____

Format of investigative report _____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

Investigation Point 1 Explain the nature of the problem you are investigating.

Investigation Point 2 Does the problem have physiological effects? If so, explain what those effects are.

Investigation Point 3 Does the problem have psychological effects? If so, explain what those effects are.

INVESTIGATION POINT 4	Explain the general social or cultural attitude about the problem.
INVESTIGATION POINT 5	Is medical intervention required for the problem? If so, describe those procedures and their effectiveness.
INVESTIGATION POINT 6	Describe the effect of this problem on the functions of the male reproductive system.
INVESTIGATION POINT 7	Describe what the future is likely to hold with regard to this problem.
INVESTIGATION POINT 8	Describe the advice you would give to someone close to you if he were having to deal with this problem.

MODULE SET II:
Major Body Systems

Module 15: Reproductive System—Female

1389

Module Contents

		Page
COMPONENTS	Learning Activities Sheet	3
	Module Objective Sheet	5
	Information Sheet	7
	Assignment Sheet	
	1—Practice Critical Thinking: Complete Case Studies that Evaluate Infant Health and Determine Required Care	31

PREREQUISITES:
Module Set I

Learning Activities Sheet

Student name _____

DIRECTIONS

Place a checkmark in the appropriate box as you complete each of the steps below.

- ❑ 1. **Take** Pretest provided by your instructor.
- ❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.
- ❑ 3. **Read** Module Objective Sheet.
- ❑ 4. **Study** Information Sheet, Objective 1 through Objective 26.
- ❑ 5. **Research** Online resources to learn more about the female reproductive system. Your instructor will list several web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____
- _____
- _____

- ❑ 6. **Take** Written Test provided by your instructor.
- ❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 8. If the evaluation is not satisfactory, repeat steps 4 through 6.
- ❑ 8. **Do** Assignment Sheet 1, "Practice Critical Thinking: Complete Case Studies that Evaluate Infant Health and Determine Required Care."
- ❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat step 8.
- ❑ 10. **Check** With your instructor for any additional assignments to be completed.

❑ 11.	Do	Additional assignments your instructor lists below. _____ _____ _____
❑ 12.	Take	Module Review provided by your instructor.
❑ 13.	Stop	Have your instructor evaluate your performance. Follow your instructor's recommendations concerning a review of the above learning activities.
❑ 14.	Stop	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test, assignment sheet, and Module Review. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

MODULE OBJECTIVE

After completing this module, you should be able to describe and identify the major structures of the female reproductive system; state the function of the structures of the female reproductive system; describe the characteristics of pregnancy, fetal development, and labor and delivery; and define common disorders and abnormalities of the female reproductive system. You should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the Written Test and on the Module Review.

SPECIFIC OBJECTIVES

After completing this module, you should be able to

1. Define the term *female reproductive system.*
2. Define the term *ovum.*
3. Define the term *fertilization.*
4. State the functions of the female reproductive system.
5. List the major divisions of the female reproductive system.
6. Define the major organs and structures of the internal female reproductive system.
7. Label the major internal organs and structures of the female reproductive system.
8. Complete statements that describe the characteristics and structure of the ovaries.
9. Complete statements that describe the characteristics and structure of the fallopian tubes.
10. Complete statements that describe the characteristics and structure of the uterus.
11. Complete statements that describe the characteristics and structure of the vagina.
12. Complete statements that describe the major structures of the external female reproductive system.
13. Label the major structures and substructures of the internal female reproductive system.
14. Label the major structures of the external female reproductive system.
15. Complete statements that describe the characteristics and structure of the breasts.
16. Label the major structures of a female breast.
17. Describe the stages of development of the female reproductive organs.
18. Complete statements that describe menstruation and the menstrual cycle.

19. Define terms associated with irregularities of the menstrual cycle.
20. Define the term *surgical menopause*.
21. Complete statements that describe the characteristics of pregnancy.
22. Complete statements that describe the characteristics of fetal development.
23. Describe the stages of labor and delivery.
24. Define terms that describe types of abnormal deliveries.
25. Complete statements that describe the characteristics of genetics and heredity.
26. Define common disorders and abnormalities of the female reproductive system.
27. Practice critical thinking: complete case studies that evaluate infant health and determine required care. (Assignment Sheet 1)

Information Sheet

OBJECTIVE 1

Define the term *female reproductive system.*

■ **Female reproductive system**—The female gonads, the associated ducts and organs, and the external genitalia that function in the procreation of offspring (see Figure 1 below)

KEY TERMS

Female gonad (go´-nad)—An ovary; the reproductive gland in a female that produces gametes

✔ **NOTE:** You will study the ovaries in Objective 6 and Objective 8.

Gamete (ga´-met)—A mature male or female germ cell; the ovum in a female (see Objective 2)

Genitalia (je-nuh-tal´-yuh)—The organs of the reproductive system and the associated structures of either sex

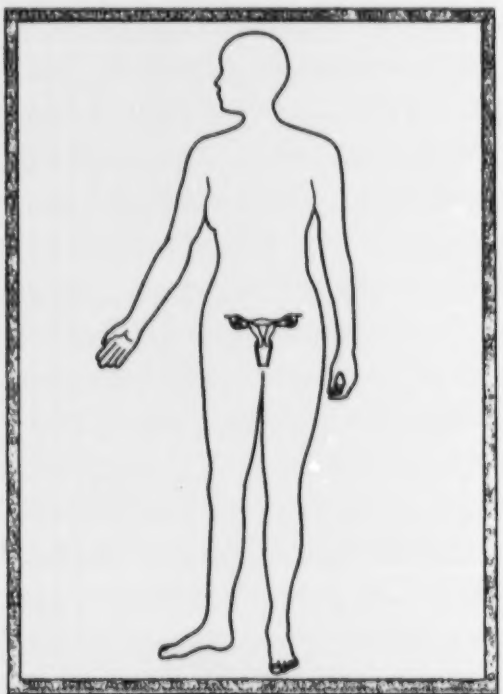


Figure 1
Female reproductive system

OBJECTIVE 2

Define the term *ovum*.

- **Ovum** (o´-vuhm)—An egg; a mature female germ cell (see Figure 2 below)

✔ **NOTE:** The plural of ovum is ova (o´-vuh). Ova develop in the ovaries and consist of a germinal vesicle—the nucleus of the ovum—and the yolk—the nutritive material that is rich in fats and proteins and is used to supply nourishment to a developing embryo (see Objective 3 for the definition of the term *embryo*.)

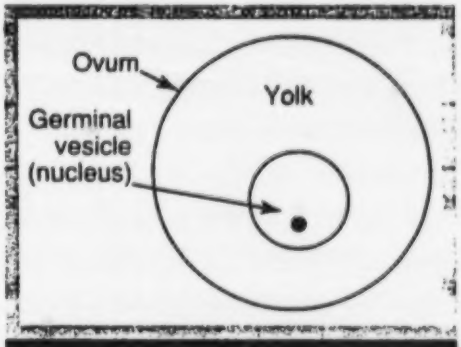


Figure 2
Ovum

OBJECTIVE 3

Define the term *fertilization*.

- **Fertilization**—The union of the male gamete (spermatozoon) and female gamete (ovum) to form a zygote from which an embryo develops (see Figure 3 on the next page)

✔ **NOTE:** Fertilization usually takes place in a fallopian tube (see Objective 6 for the definition of the term *fallopian tube*) of the female when a spermatozoon (with 23 chromosomes) carried in the semen discharged from the male comes in contact with and penetrates an ovum (with 23 chromosomes). Rapid chemical changes in the membrane of the ovum prevent entrance of additional spermatozoa. Fusion of the ovum and spermatozoon restores the normal number of chromosomes (46) to the germ cell.

KEY TERMS

Zygote (zi´-got)—The cell formed by the union of two gametes; a developing ovum from the time it is fertilized until it is implanted in the uterus (see Objective 6 for a definition of the term *uterus*)

Embryo (em´-bre-o)—The unborn offspring of a human being between the time of implantation of the fertilized ovum about 2 weeks after fertilization until the end of the seventh or eighth week, when it becomes a fetus

Fetus (fe´-tuhs)—The unborn offspring of a human after it has attained the particular form of the species; the developing human being after the embryonic period and until its birth

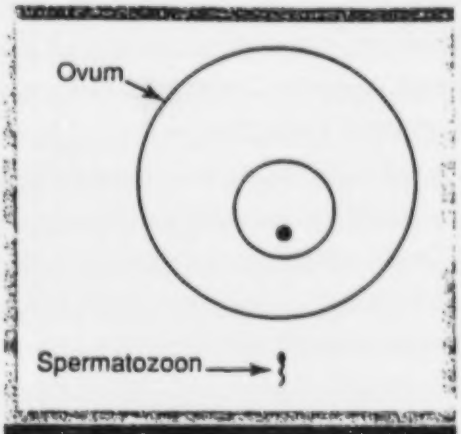


Figure 3
Fertilization

OBJECTIVE 4

State the functions of the female reproductive system.

✔ **NOTE:** Compare this listing to that for the male, which you studied in Module 14.

1. **Perpetuation of the human species**

2. **Development of the fetus**

   ✔ **NOTE:** In previous modules, you studied about the placenta and how it serves as a bridge between the mother and the fetus during pregnancy. That aspect of the circulatory system is just one way in which the female reproductive system supports development of the fetus.

3. **Sexual gratification**

4. **Secretion of hormones**

   ✔ **NOTE:** As with the male, the hormones secreted by the reproductive system lead to the development of the secondary sex characteristics of the female that include (1) the development of breasts, (2) broadening of the hips, (3) growth of hair on the pubis and axilla, and (4) onset of **menstruation**. Generally, these secondary sex characteristics prepare the female body for motherhood. For example, the development of breasts and broadening of hips accentuate the female form, making the woman more attractive to potential mates while also preparing her to deliver a baby and nurse it.

KEY TERM

Menstruation (men-stru-wa´-shuhn)—The discharging of blood, secretions, and tissue debris from the uterus that recurs in nonpregnant, mature females at approximately monthly intervals

OBJECTIVE 5 **List the major divisions of the female reproductive system.**

1. **Internal**

   ✔ **NOTE:** The internal portion of the female reproductive system includes the ovaries and the series of ducts and organs that lead to the exterior. You will study the organs and structures of the internal female reproductive system in Objective 6 through Objective 11.

2. **External**

   ✔ **NOTE:** You will study the structures of the external female reproductive system in Objective 12 through Objective 14.

3. **Breasts**

   ✔ **NOTE:** The breasts—also called the *mammary glands*—are the two glands on the chest of a mature female that are capable of secreting milk. You will study more about the breasts in Objective 15 and Objective 16.

OBJECTIVE 6 **Define the major organs and structures of the internal female reproductive system** (see Figure 4 on the next page and Figure 5 on page 16).

1. **Ovary** (o´-vuh-re)—One of a pair of internal female reproductive organs that are found on each side of the lower abdomen on either side of the uterus and that produce ova and female sex hormones

   ✔ **NOTE:** You will study more about the ovaries in Objective 8.

2. **Fallopian** (fuh-lo´-pe-uhn) **tube**—Either of a pair of internal tubes that conduct an ovum from an ovary to the uterus

   ✔ **NOTE:** The fallopian tubes are also called the *uterine tubes*, *salpinges* (sal-puhn´-jez), or *oviducts* (o´-vuh-duhkts). You will learn more about the fallopian tubes in Objective 9.

3. **Uterus** (yu´-tuh-ruhs)—The womb; the hollow, pear-shaped internal female organ of reproduction in which the fertilized ovum is implanted and the fetus develops

   ✔ **NOTE:** You will study more about the uterus in Objective 10.

4. **Vagina** (vuh-ji´-nuh)—The canal in a female that leads from the uterus to the external vaginal orifice of the genital canal

   ✔ **NOTE:** You will learn more about the vagina in Objective 11.

Objective 7 **Label the major internal organs and structures of the female reproductive system** (see Figure 4).

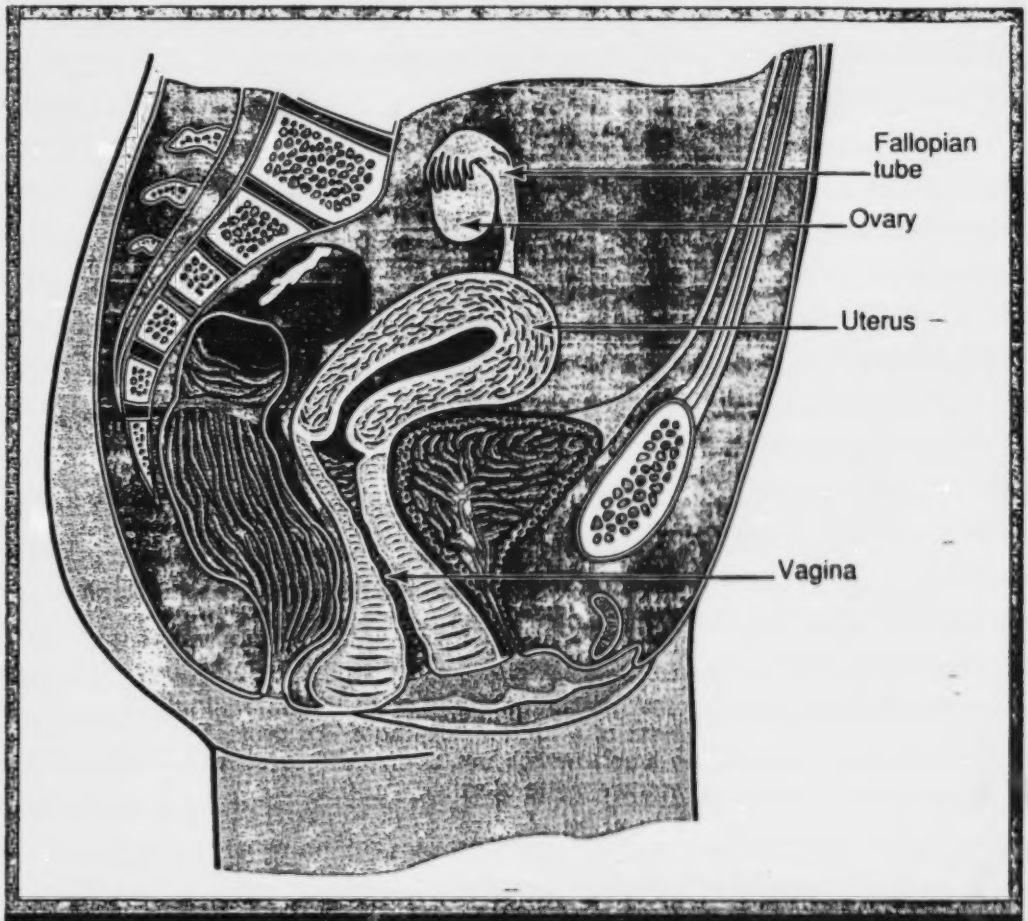


Figure 4
Major internal organs and structures of the female reproductive system

Objective 8 **Complete statements that describe the characteristics and structure of the ovaries.**

1. **Each of the two ovaries resembles an almond in size and shape** (see Figure 5 on page 16).

2. **The ovaries are located on either side of the uterus and are attached to the back of the broad ligament behind and below the fallopian tubes; each ovary lies between the folds of the broad ligament.**

3. **The ovaries are anchored to the uterus by the ovarian ligament** (see Figure 5 on page 16).

4. **The major functions of the ovaries are to produce, develop, mature, and discharge ova and to secrete the female hormones estrogen** (es´-truh-juhn) **and progesterone** (pro-jes´-tuh-ron).

5. **Estrogen helps in the development of female secondary sex characteristics and in the growth of the female reproductive organs.**

6. **Progesterone contributes to the growth of the endometrium and in the maintenance of pregnancy.**

KEY TERM

Endometrium (en-do-me´-tre-uhm)—The mucous membrane that lines the uterus and sloughs off during menstruation and following the birth of a child

OBJECTIVE 9

Complete statements that describe the characteristics and structure of the fallopian tubes.

1. **Each fallopian tube is approximately 4 inches (100 millimeters) long and is muscular and lined with mucosa.**

2. **Each fallopian tube is attached to the upper, outer angles of the uterus and opens into the uterus** (see Figure 5 on page 16).

3. **At the point of attachment to the uterus, each fallopian tube is very narrow but gradually increases in size so that the distal end is larger** (see Figure 5 on page 16).

4. **The margin of each distal end is funnel-shaped** (see Figure 5 on page 16) **and consists of a number of finger-like projections called the *fimbriae tubae*** (fim´-bre-e tyub´), **which are connected to an ovary and contain cilia that move an ovum toward the uterus.**

5. **The fallopian tubes provide an area where the ovum is nourished and delayed for fertilization.**

6. **The fallopian tubes provide the place for fertilization and act as the passageway for spermatozoa.**

7. **Peristaltic motion in the fallopian tubes moves the ova toward the uterus to be implanted if it is fertilized and to be shed with the uterine lining if it is not fertilized.**

OBJECTIVE 10

Complete statements that describe the characteristics and structure of the uterus.

1. **The uterus is a muscular organ located in the pelvic cavity anterior to the rectum and posterior to the urinary bladder.**

2. **The uterus is not firmly attached to any part of the skeleton but is instead suspended in the pelvic cavity by various ligaments.**

3. **The uterus is approximately 3 inches (75 millimeters) long, about 2 inches (50 millimeters) wide at the upper end, and about 1 inch (25 millimeters) thick.**

4. **The uterus consists of three major sections: the fundus** (fuhn´-duhs), **the body, and the cervix** (suhr´-viks) (see Figure 5 on page 16).

5. **The fundus is the convex, rounded superior portion of the uterus, measuring about 3 inches (75 millimeters) long and 2 inches (50 millimeters) wide at its widest point.**

6. **The cervix is the lowest, constricted portion of the uterus that extends into the vagina.**

7. **The body is the middle portion of the uterus between the fundus and the cervix.**

8. **The uterine cavity** (see Figure 5 on page 16) **is triangular in shape with an opening in each angle of the triangle, including the fallopian tubes at the top two angles of the triangle and the opening to the cervix below.**

9. **The uterine cavity is small because of the thickness of the muscular walls.**

10. **The uterus serves three main functions: to contain and nourish the embryo and the developing fetus from the time the fertilized egg is implanted until the time of delivery, which is the condition of pregnancy; to contract its muscles to expel the fetus at the end of pregnancy, which is the process of labor; and to slough off the endometrium if an egg is not implanted, which is the process of menstruation.**

    ✔ **NOTE:** The purpose of the uterus is to provide a place within the body in which a fetus can develop. Each month during a woman's fertile years, the uterus prepares to receive a fertilized egg if one has not already been implanted. If there is no fertilized ovum, then the prepared wall is sloughed off in order to prepare for the next ovulation at which time an ovum may become fertilized. Thus, the three functional stages of the uterus are menstruation, pregnancy, and delivery of the baby at birth.

11. **The uterus becomes enormously enlarged during pregnancy, increasing to 12 inches (300 millimeters) or more in length, and 8 to 10 inches (200 to 250 millimeters) in width.**

12. **The uterus returns to near its original size after delivery, but it is always slightly larger than before pregnancy.**

13. **After menopause, the uterus becomes smaller and atrophies.**

KEY TERM

Menopause (me´-nuh-poz)—The cessation of menstruation usually occurring between the ages of 45 and 50

14. **Because the uterus is a suspended structure, it is subject to displacement.**

15. **Normally, the cervix points toward the lower end of the sacrum with the fundus inclined forward toward the suprapubic region, but uterine position is altered by gravity or by change in body position.**

16. **A full bladder tilts the uterus backward; a distended rectum tilts the uterus forward.**

17. **Anteversion** (an-te-vuhr´-zhuhn) **is an abnormal forward tilt of the uterus.**

18. **Anteflexion** (an-te-flek´-shuhn) **is an abnormal forward bending of the fundus and the body at the cervix, which may or may not include displacement of the cervix.**

19. **Retroversion** (re-tro-vuhr´-zhuhn) **is an abnormal backward bending of the fundus and the body at the cervix, with the position of the cervix usually unchanged.**

OBJECTIVE 11 **Complete statements that describe the characteristics and structure of the vagina.**

1. **The vagina** (vuh-ji´-nuh) **is a muscular canal lined with mucous membrane and situated in front of the rectum and behind the urethra and urinary bladder.**

2. **The vagina has folds of rugae and is a collapsible tube that is the passageway from the uterus to outside the body** (see Figure 5 on page 16).

3. **The posterior wall of the vagina is approximately 3 to 4 inches (75 to 100 millimeters) long, and the anterior wall is approximately 2½ to 3 inches (65 to 75 millimeters) long.**

4. **The principal functions of the vagina are to receive the penis during copulation, to receive the seminal fluid from the male, to serve as the lower part of the birth canal by stretching to allow the passage of the fetus, and to act as the excretory duct for uterine secretions and menstrual flow.**

OBJECTIVE 12 **Complete statements that describe the major structures of the external female reproductive system.**

✔ **NOTE:** The external structures of the female reproductive system protect the openings of the urinary and reproductive systems and enhance sexual excitement. Increased sexual excitement leads to a greater production of vaginal fluids, which lubricate the vagina during intercourse. These structures contribute to the female orgasm and sexual gratification.

1. **The vulva** (vuhl´-vuh) **is the external genitalia of women that comprises the mons pubis** (mawnz´ pyu´-buhs), **labia majora** (la´-be-uh muh-jor´-uh), **labia minora** (muh-nor´-uh), **clitoris** (kli´-tuh-ruhs), **urinary orifice, vaginal orifice, and Bartholin's** (bawr´-thuh-luhnz) **glands** (see Figure 5 on page 16 and Figure 6 on page 17).

2. **The mons pubis is the prominent, skin-covered fat pad over the symphysis pubis that becomes covered with hair after puberty** (see Figure 6 on page 17).

   ✔ **NOTE:** The mon pubis is also called the *mons veneris* (ve´-nuh-ruhs).

3. **The labia majora are the two outer, fatty longitudinal folds of skin on each side of the vaginal orifice that are covered with pigmented skin and hair on the outer surface but that are free of hair on the inside mucous lining** (see Figure 6 on page 17).

4. **The labia minora are the two longitudinal folds of epithelial tissue located within the labia majora that come together at their anterior in the prepuce of the clitoris** (see Figure 6 on page 17).

5. **The clitoris is the small, erectile organ at the anterior part of the vulva that is similar to the penis in men** (see Figure 6 on page 17).

   ✔ **NOTE:** The response of the clitoris to sexual stimulation is similar to that of the penis and the structure is anatomically equivalent to the glans penis and is even covered by a flap of tissue called the *prepuce*. The clitoris enlarges during sexual stimulation, though the effect is not as dramatic as penile erection.

6. **The urinary orifice—also called the *urinary meatus*—is the external opening of the urethra** (see Figure 6 on page 17).

7. **The vaginal orifice—also called the *vaginal meatus*—is the external opening of the uterus** (see Figure 6 on page 17).

8. **Bartholin's glands are the two bean-shaped glands on either side of the vaginal orifice that secrete lubricating fluid** (see Figure 5 on the next page).

   ✔ **NOTE:** The Bartholin's glands are also referred to as the *greater vestibular glands*. They are equivalent to the Cowper's glands in the male.

9. **The perineum** (per-uh-ne´-uhm) **is the region between the vaginal orifice and the anus, composing the muscular floor of the pelvis** (see Figure 6 on page 17).

OBJECTIVE 13 **Label the major structures and substructures of the internal female reproductive system** (see Figure 5).

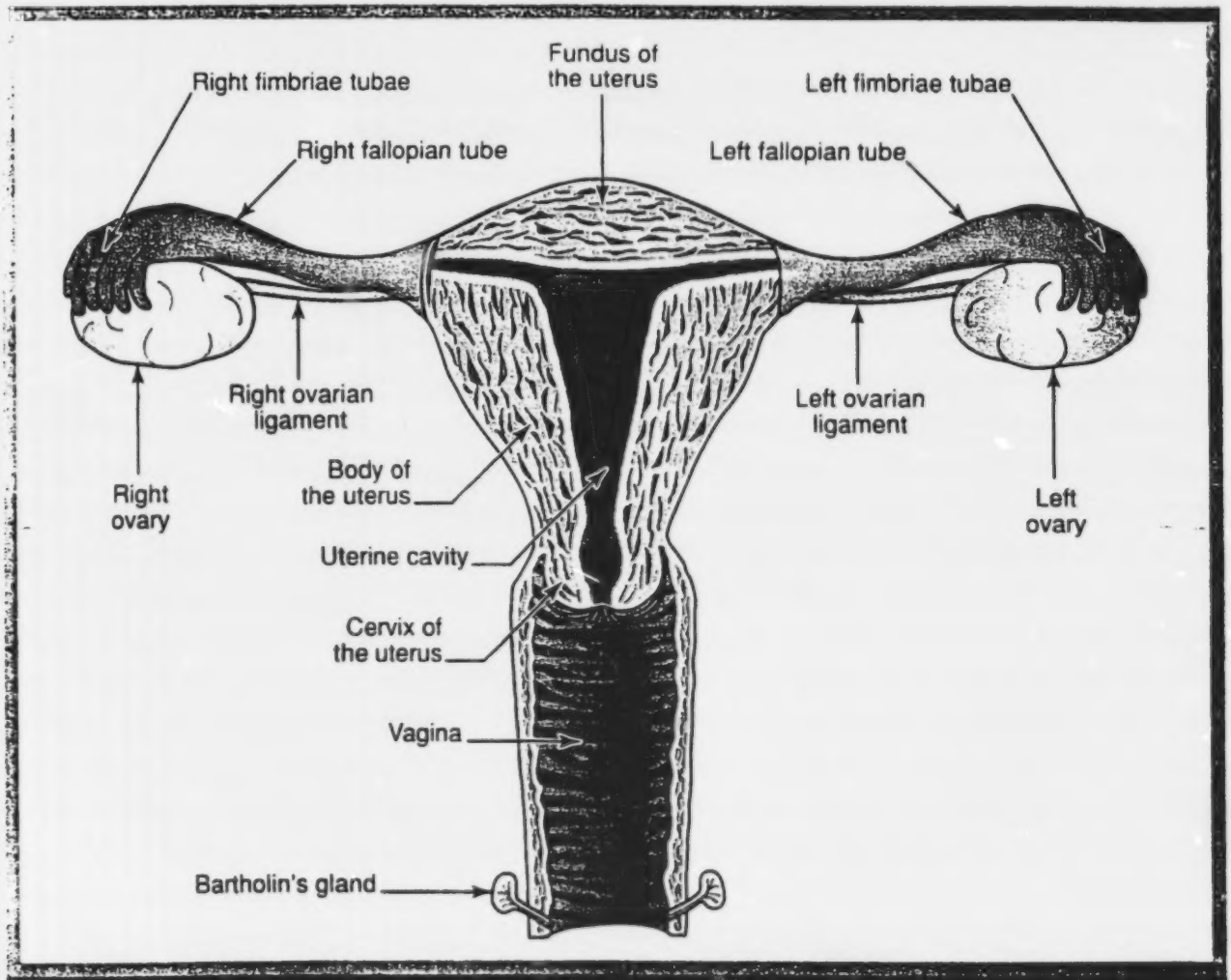


Figure 5
Major structures and substructures of the internal female reproductive system

OBJECTIVE 14 | **Label the major structures of the external female reproductive system** (see Figure 6).

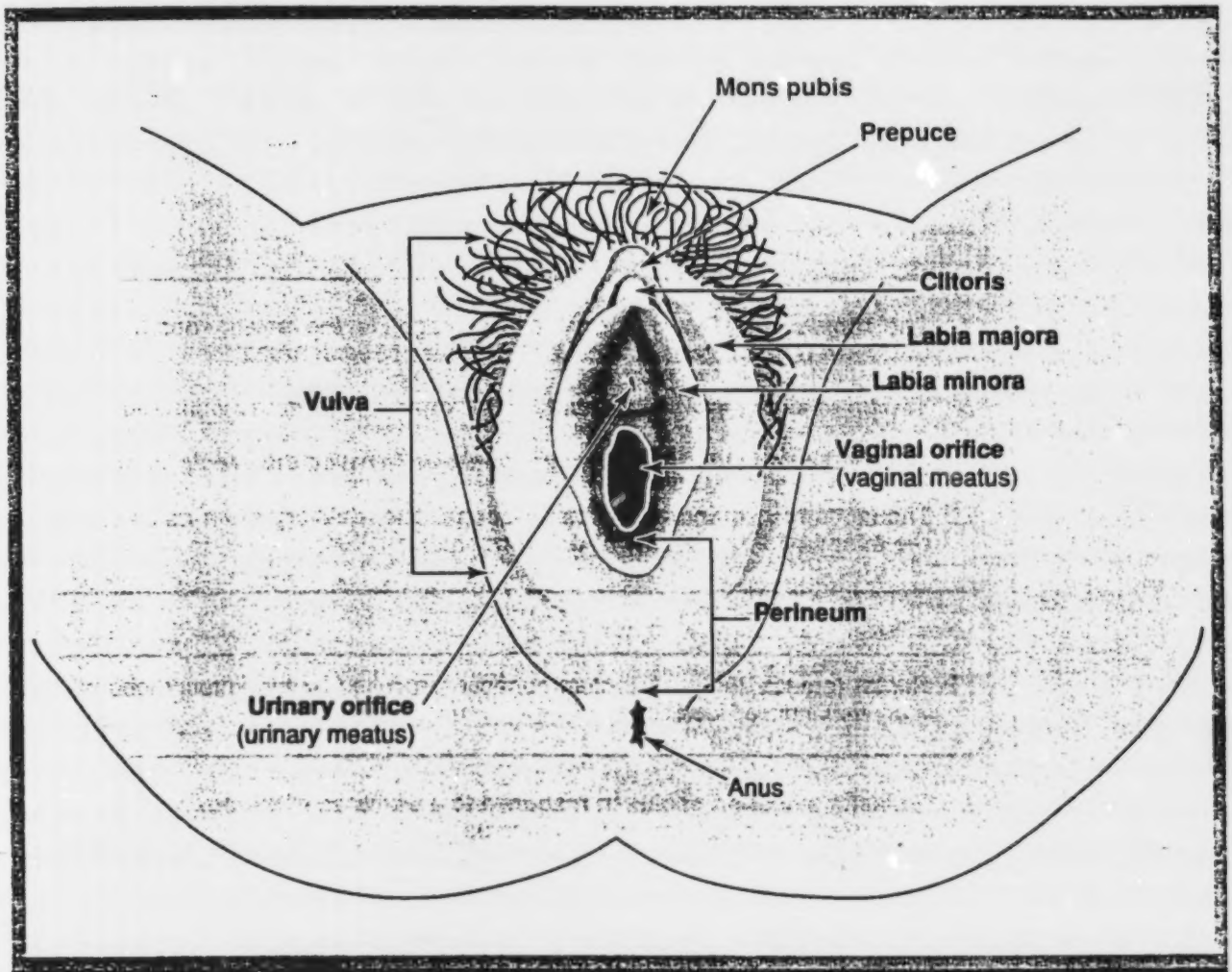


Figure 6
Major structures of the external female reproductive system

OBJECTIVE 15 | **Complete statements that describe the characteristics and structure of the breasts.**

1. **The breasts lie over the pectoralis muscle and each is attached to the pectoralis muscle by a layer of connective fascia tissue** (see Figure 7 on page 19).

2. **The central portion of each breast is filled with glandular tissue; the outer portion is made up of mostly adipose tissue** (see Figure 7 on page 19).

3. **The glandular tissue—called the *lactiferous glands*** (see Figure 7 on page 19)**—consists of a series of lobes; each lobe has a system of ducts and sinuses for the passage of milk to the nipple.**

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KEY TERMS

Lactiferous (lak-ti´-fuh-ruhs)—Of or pertaining to a structure that produces or conveys milk, such as the ducts of the breasts

✔ **NOTE:** Lactation (lak-ta´-shuhn) is the process of the synthesis and secretion of milk from the breasts. The lactiferous glands are the portion of the breasts that produce milk.

Sinus—A dilated channel

4. **The nipple** (see Figure 7 on the next page) **is the small, round, pigmented structure that projects just below the center of each breast.**

5. **The tip of each nipple has about 20 tiny openings from the lactiferous ducts.**

6. **The pigmented skin that surrounds a nipple is called the *areola*** (uh-re´-uh-luh).

7. **The lactiferous glands become functional after delivery of an infant when they are stimulated by the flow of the hormone prolactin.**

KEY TERM

Prolactin (pro-lak´-tuhn)—A protein hormone produced by the anterior lobe of the pituitary that induces lactation

8. **Prolactin secretion begins in response to a decrease of estrogen in the blood as a result of the expulsion of the placenta.**

9. **It takes three or four days for the estrogen level to drop enough so that prolactin stimulates the production of milk in the breasts; during those three or four days, the breasts produce a thin, yellowish secretion called *colostrum*** (kuh-laws´-truhm).

10. **Colostrum consists of maternal antibodies to boost the infant's immune system, white blood cells, water, protein, fat, minerals, vitamins, and carbohydrates.**

OBJECTIVE 16 **Label the major structures of a female breast** (see Figure 7).

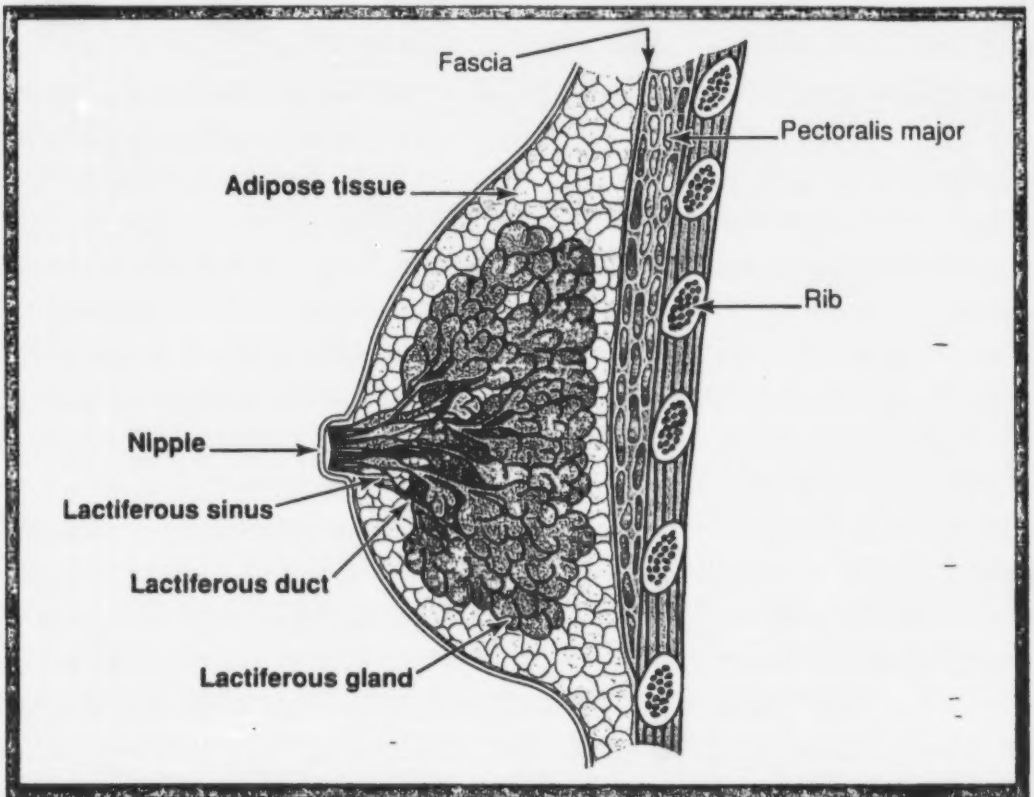

Figure 7
Major structures of a breast (lateral view)

OBJECTIVE 17 **Describe the stages of development of the female reproductive organs.**

✔ **NOTE:** As you study this objective, consider the corresponding material presented in Module 14 on the male reproductive system and note similarities and differences.

1. **For approximately the first two months of embryonic life, no sexual differentiation is evident, though by the end of the third month, the sex of the fetus is clearly distinguishable.**

2. **At birth, the ovaries contain thousands of immature germ cells called *oocytes*** (o´-uh-sitz).

   ✔ **NOTE:** Just as male children are born with the immature cells that will form spermatozoa after puberty, the female child is born with the oocytes that will eventually produce ova. Of the half million oocytes at birth, about 80 percent will remain at puberty. Of those, approximately 1000 will complete meiosis to become secondary **follicles** (see Figure 8 on page 21). During each **menstrual cycle**, one and generally only one follicle will mature completely to be released to the surface of the ovary; this process is called ***ovulation***.

KEY TERMS

Follicle (faw´-li-kuhl)—A cavity or recess in an ovary that contains a liquor that divides follicular cells into layers that surrounds an ovum

Menstrual (men{t}´-stru-uhl) **cycle**—A series of events that take place in a nonpregnant woman between puberty and menopause that involves the release of an ovum and the shedding of the lining of the uterus occurring approximately every 28 to 30 days; the time covered by the process of menstruation

✔ **NOTE:** You will study the menstrual cycle in the next objective.

Ovulation (awv-yuh-la´-shuhn)—The release of an ovum by the ovaries

3. **Puberty is indicated in the female by the onset of ovulation and menstruation and the appearance of secondary sexual characteristics.**

4. **The ovaries usually become inactive at about 45 years of age; the cessation of ovulation and menstruation is referred to as *menopause*.**

OBJECTIVE 18

Complete statements that describe menstruation and the menstrual cycle.

1. **The onset of menstruation—referred to as *menarche* (me´-nawr-ke)—occurs at puberty (10 to 16 years of age) and ceases permanently within the onset of menopause (40 to 50 years of age).**

2. **Menstrual discharge consists of endometrial tissue, blood, and serous fluid.**

3. **Menstruation ceases temporarily during pregnancy.**

4. **Menstruation may or may not cease during lactation.**

5. **Menstruation may be disrupted due to emotional or hormonal disturbances, physical disorders, congenital disorders, malnutrition, and other factors.**

6. **The menstrual cycle lasts 27 to 28 days on the average.**

   ✔ **NOTE:** While the normal menstrual cycle is considered to be 28 days, the actual number of days may vary from approximately 23 to about 35. This variant number may be normal for an individual or it may be an occasional deviation, especially in times of illness or dietary changes. Some women, especially those with very low body fat, may temporarily stop menstruating, a condition called *amenorrhea* (a-me-nuh-re´-uh) (see Objective 19).

7. **The onset of the menstrual cycle is caused by the reduction of ovarian hormones when an ovum is not fertilized.**

8. **A menstrual cycle is a series of five phases that prepares the female body to become pregnant and then prepares it to try again if an ovum is not fertilized.**

9. **The first phase—called the *menstrual phase*—lasts 4 to 5 days; during this phase, there is a period of uterine bleeding accompanied by shedding of the endometrium and secretion of the follicle-stimulating hormone (FSH), causing a follicle** (see Figure 8 below) **to begin to develop in the ovary** (see Figure 9 on the next page).

10. **The second phase—called the *follicular*** (fuh-li´-kyuh-luhr) ***phase*—lasts 9 to 10 days; during this phase, the endometrium is repaired and thickens and the follicle continues to develop and secretes estrogen** (see Figure 9 on the next page).

11. **The third phase—called the *ovulation phase*—usually occurs on the 14th day of the cycle; during this phase, the endometrium continues to thicken and the follicle ruptures and liberates an ovum that moves on to the fallopian tubes** (see Figure 9 on the next page).

12. **The fourth phase—called the *luteal*** (lu´-te-uhl) ***phase*—lasts 10 to 12 days; during this phase, the endometrium continues to thicken and prepare for the receipt of the ovum if it is fertilized; the corpus luteum** (kor´-puhs lu´-te-uhm)**—a gland that buds from the ruptured follicle** (see Figure 8 below)**—begins to develop and secrete progesterone** (see Figure 9 on the next page).

13. **The purpose of progesterone is to spur the growth of blood vessels in the endometrium so the uterus will be ready to support a fertilized egg. If a fertilized egg implants, the menstrual cycle is broken and pregnancy begins. Otherwise, the cycle continues.**

14. **The fifth phase—called the *ischemic*** (is-ke´-mik) ***phase*—lasts 1 to 2 days; during this phase, the arteries constrict and the endometrium becomes anemic and shrinks; also, the corpus luteum begins to shrivel to form a structure called the *corpus albicans*—a scar on the surface of the ovary—and the production of progesterone is reduced** (see Figure 9 on the next page).

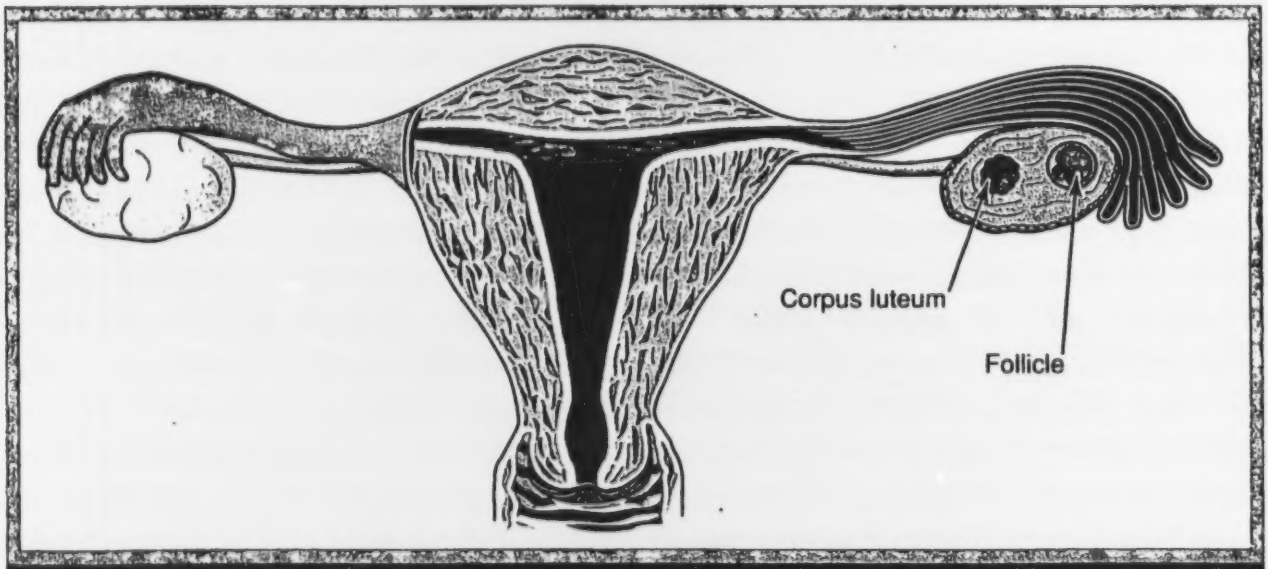

Figure 8
Follicle and corpus luteum

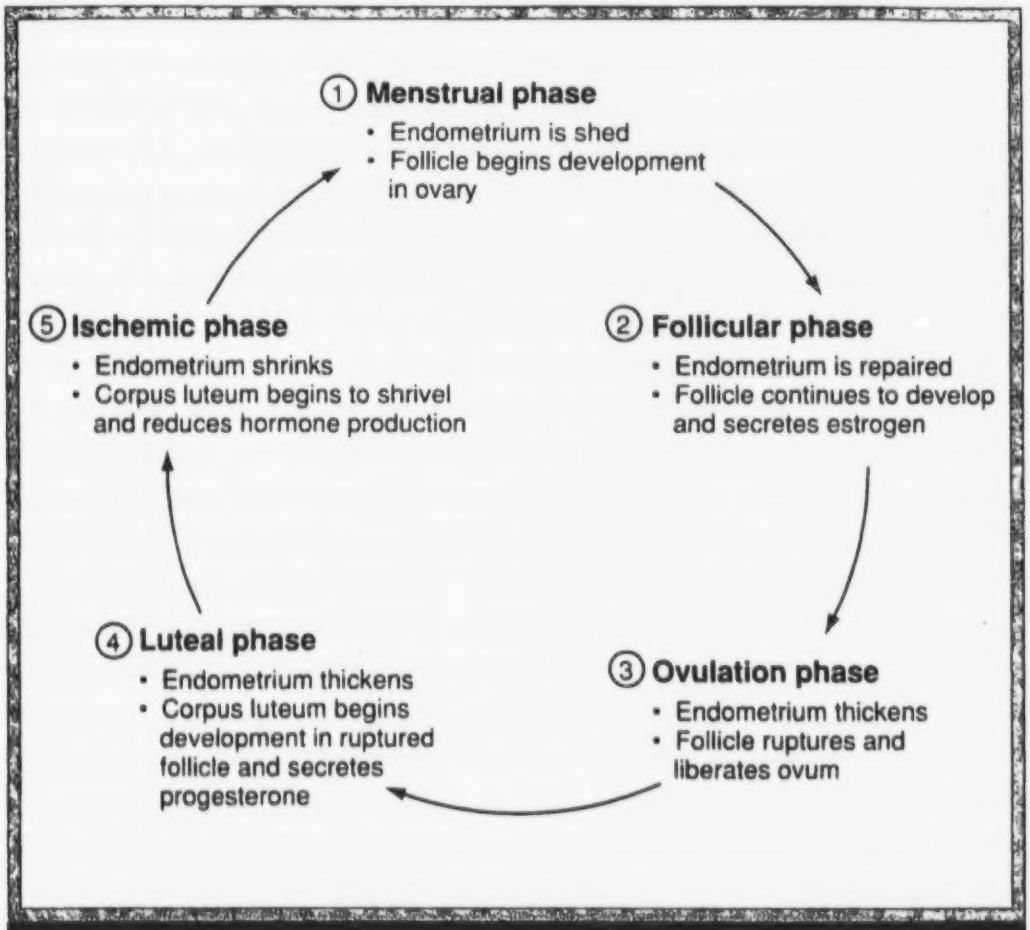
1 Menstrual phase
• Endometrium is shed
• Follicle begins development in ovary
2 Follicular phase
• Endometrium is repaired
• Follicle continues to develop and secretes estrogen
3 Ovulation phase
• Endometrium thickens
• Follicle ruptures and liberates ovum
4 Luteal phase
• Endometrium thickens
• Corpus luteum begins development in ruptured follicle and secretes progesterone
5 Ischemic phase
• Endometrium shrinks
• Corpus luteum begins to shrivel and reduces hormone production

Figure 9
Phases of the menstrual cycle

OBJECTIVE 19 **Define terms associated with irregularities of the menstrual cycle.**

✔ **NOTE:** While menstruation consists of a series of cyclic events involving a number of hormones and physiological changes, the most-obvious indication of the events is the flow of blood and other substances as discharge if the ovum is not fertilized. Variations in this flow can be indications of abnormal **menses**.

KEY TERM

Menses (men´-sez)—The menstrual flow

1. **Amenorrhea** (a-me-nuh-re´-uh)—The absence of menstruation

   ✓ **NOTE:** Amenorrhea is normal before sexual maturity, during pregnancy, and after menopause, but it may otherwise be caused by dysfunction of the hypothalamus, pituitary gland, ovary, or uterus.

2. **Oligomenorrhea** (aw-li-go-me-nuh-re´-uh)—Abnormally light or infrequent menstruation

KEY TERMS

meno- —A combining form meaning "of or related to the menses"

-(r)rhea—A suffix meaning "fluid discharge or flow"

oligo- —A combining form meaning "few" or "little"

3. **Dysmenorrhea** (dis-me-nuh-re´-uh)—Pain associated with menstruation

   ✓ **NOTE:** Menstrual pain is extremely common and occurs at least occasionally in most women. However, approximately 10 percent of women experience severe pain in the lower back that comes in waves associated with intense uterine contractions. Other symptoms may include nausea, vomiting, dizziness, and fainting.

4. **Menorrhagia** (me-nuh-ra´-je-uh)—Abnormally heavy or long menstrual periods

   ✓ **NOTE:** Menorrhagia occurs occasionally in most women's lives; however, chronic menorrhagia may cause anemia.

5. **Metrorrhagia** (me-truh-ra´-je-uh)—Uterine bleeding other than that caused by menstruation

KEY TERMS

-(r)rhagia—A suffix meaning a "fluid discharge of excessive quantity"

metro- —A prefix meaning "of or related to the uterus"

OBJECTIVE 20

Define the term *surgical menopause*.

- **Surgical menopause**—The removal of an organ, such as the ovaries or uterus, so as to interrupt the hormones or physiological structures that regulate menstruation

  ✓ **NOTE:** Surgical removal of one of the reproductive organs may be done as a contraceptive procedure, but surgical menopause is most often an unpreventable consequence of a procedure directed at a disease or injury. For example, ovarian cancer may lead to the removal of the ovaries.

OBJECTIVE 21

Complete statements that describe the characteristics of pregnancy.

1. **Pregnancy—also called *gestation*** (je-sta´-shuhn)**—begins with fertilization; as soon as the sperm enters the ovum, cellular changes take place and the embryo begins to form.**

   ✔ **NOTE:** The ovum releases chemicals that attract sperm to the egg. Receptor molecules on the surface of the ovum help the spermatozoon to attach to the ovum. Once attached, the sperm releases enzymes that break down the outer layer of the ovum, allowing the sperm to penetrate into the cytoplasm of the egg. The plasma layers of the two cells fuse, and the nucleus of the sperm moves into the ovum. As soon as the head and neck of a sperm have penetrated the ovum, the flagellum of the sperm falls off and the egg releases chemicals that inactivate the receptors on the cell's surface so that no other spermatozoa are allowed to attach. This is explained further in Objective 25.

2. **During pregnancy, the mother's uterus changes shape and size, the vagina elongates, and the umbilical cord forms and extends from the placenta to the embryo.**

3. **Two umbilical arteries run through the umbilical cord to carry blood from the fetus to the capillaries of the fetal placenta, while the umbilical vein returns blood to the fetus.**

4. **The fetus is surrounded by a thin membrane forming a sac—called the *amnion*** (am´-ne-awn)**—and containing a serous fluid—called the *amniotic*** (am-ne-aw´-tik) ***fluid*****—in which the fetus is immersed.**

5. **The mother's body performs the function of eliminating waste and acquiring food for the fetus by osmosis through the placental membranes.**

   ✔ **NOTE:** Recall that osmosis is the flow of a liquid through a semipermeable membrane from an area of higher solute concentration to an area of lower solute concentration. In this case, the higher concentrations of nutrients in the mother's blood flow to the lower concentration of nutrients in the fetal blood while waste products follow the opposite path.

6. **The average pregnancy lasts approximately 280 days and is followed by childbirth, which is also called *parturition*** (pawr-chuh-ri´shuhn)**.**

7. **The fetus is delivered when the cervix of the uterus dilates and flattens enough to allow the fetus to be pushed into the vaginal canal by the muscles of the fundus and body of the uterus and the muscles of the vagina.**

OBJECTIVE 22

Complete statements that describe the characteristics of fetal development.

1. **During ovulation, an egg is released from the ovary and begins moving down the fallopian tube toward the uterus.**

2. **As a spermatozoon makes its way through the fluid of the uterus and fallopian tube, it capacitates** (kuh-pa´-suh-tatz)**, which results in the head, or acrosome** (a´-kruh-som)**, of the sperm fracturing so that its enzymes are secreted.**

3. **The enzymes eat through the outer wall of the ovum when the sperm contacts it, allowing the sperm to enter the ovum.**

4. **The entry of the sperm nucleus into the ovum causes the membrane of the ovum to change, preventing the entry of other sperm.**

5. **The ovum has 23 pairs of chromosomes** (kro´-muh-somz)**: one pair of X chromosomes that contribute to sexual characteristics and 22 that determine other inherited traits.**

6. **The sperm has 23 pairs of chromosomes: 22 that determine the majority of inherited characteristics and a pair of X or Y chromosomes so that fertilization of the ovum by an X-bearing sperm will result in a female fetus while fertilization by a Y-bearing sperm will result in a male fetus.**

   ✔ **NOTE:** Thus, the sex of the fetus is determined at conception by the chromosomes of the sperm that fertilizes the egg. Other characteristics of the fetus will be the result of a combining of the genes of the two parents.

7. **The nuclei of the sperm and ovum fuse and the cell begins dividing, forming a two-cell stage within 36 hours and a four-cell stage within 48 hours.**

8. **After about 3 days, the fertilized ovum has become a solid mass of 16 cells called the *morula*** (mor´-yuh-luh) **and is nearing the opening of the fallopian tube into the uterus.**

9. **At this point, a hollow space develops within the mass of cells forming what is called the *blastocyst*** (blas´-tuh-sist) ***stage* of development.**

10. **As the blastocyst enters the uterus seven to eight days after fertilization, it secretes enzymes that eat into the endometrium, allowing the blastocyst to implant in a cavity in the wall of the uterus.**

11. **The implanted blastocyst then undergoes embryonic development over the next eight weeks, creating the embryonic disc.**

12. **The amnion forms around the embryo and becomes filled with amniotic fluid.**

13. **Embryonic growth continues, during which time all of the organ systems will be established and the structural buds of the body will form.**

14. **Weeks 9 through 40 define the fetal stage, during which development continues and the fetus is nourished by the mother's systems through the umbilical cord and placenta.**

OBJECTIVE 23 **Describe the stages of labor and delivery.**

✔ **NOTE:** At the end of the pregnancy, the infant is delivered through a series of events that follow a fairly strict pattern. The fetus positions itself with the head toward the birth canal. Hormonal changes prepare the uterus and the pelvis for delivery of the baby. The total sequence of the three stages listed may range from a few hours to a few days.

1. **Stage one**—The secretion of progesterone decreases and the secretion of estrogen increases, causing weak, irregular contractions that force the amnion into the cervix; this dilates the cervix and eventually ruptures the amnion

   ✔ **NOTE:** The rupture of the amnion results in the expulsion of amniotic fluid that is commonly referred to as *the water breaking.* Once this happens, delivery of the baby must occur within a few hours for the fetus is no longer protected against the environment, pathogens, dehydration, and other complications. If the second stage does not begin, then medical personnel will have to induce delivery—administer drugs that are equivalent to hormones that set off the second stage.

2. **Stage two**—The secretion of oxytocin (awk-si-to´-suhn) by the posterior pituitary gland produces powerful contractions in the uterus that push the fetus from the uterus and out the birth canal

   ✔ **NOTE:** Complications may occur at this point that prevent normal delivery. For example, the baby may be breeched—in a position other than head first. The baby may be too large or the cervix may not dilate adequately. If normal delivery is not possible, surgical delivery through a procedure known as *cesarean* (si-zar´-e-uhn) *section* or C-section must be used.

3. **Stage three**—Continued uterine contractions expel the placenta from the uterus and out the birth canal

OBJECTIVE 24 **Define terms that describe types of abnormal deliveries.**

1. **Premature birth**—Delivery of the infant after less than 40 weeks of pregnancy
2. **Breech birth**—Presentation of the infant at birth in any position other than head downward
3. **Cesarean section**—Delivery of an infant by surgically opening the abdomen and uterus
4. **Still birth**—Delivery of a lifeless infant
5. **Multiple births**—Delivery of more than one infant from a pregnancy

   ✔ **NOTE:** Multiple births result from one of two situations. Sometimes a fertilized ovum will split. Children from this process are referred to as *identical multiples* (twins, triplets, etc.) because only one set of genes is involved so that the individuals are genetically identical. Other multiple births result from more than one ova being fertilized and implanting. Because this type of fertilization involves separate ova and separate sperm, the fetuses are genetically different and are referred to as *fraternal multiples.*

OBJECTIVE 25 **Complete statements that describe the characteristics of genetics and heredity.**

1. **Each of the cells of the human body—except for ova, sperm, and mature red blood cells—contain 46 chromosomes that have spawned from the original 46 chromosomes that were united through the fertilization of the ovum.**

2. **The 46 chromosomes exist in pairs that include 22 autosomes** (o´-tuh-soms) **numbered 1 to 22 and one pair of sex chromosomes.**

3. **One chromosome in each pair originated in the ovum and is referred to as a *maternal chromosome*, while the second chromosome of the pair originated in the sperm and is called a *paternal chromosome*.**

4. **Chromosomes consist of deoxyribonucleic acid (DNA) and protein.**

5. **DNA consists of four base compounds found in complementary pairs of adenine** (a´-duhn-en) **with thymine** (thi´-men) **and guanine** (gwaw´-nen) **with cytosine** (si-tuh-sen).

6. **These four compounds create proteins; the segment of DNA for a protein is called a *gene*** (jen´).

7. **The arrangement of these base compounds within a gene creates a code that determines the inherited characteristics of an individual.**

8. **Each possibility for how a gene can affect an individual is called an *allele*** (uh-le{uh}l´), **and there are at least two alleles for each gene.**

9. **When the two alleles are the same, a homozygous** (ho-muh-zi´-guhs) **condition exists; a heterozygous** (he-tuh-ro-zi´-guhs) **condition exists if the alleles are different; this similarity or difference in alleles is referred to as the *genotype*** (je´-nuh-tip).

10. **Normally one allele is dominant and the other is recessive; the way the alleles are expressed or exhibited in an individual is called the *phenotype*** (fe´-nuh-tip).

    ✔ **NOTE:** For example, the gene for brown eyes is dominant, while the gene for blue eyes is recessive. Therefore, if one parent has brown eyes and the other parent has blue eyes, the probability is greater that their children will have brown eyes.

11. **In some cases, the genetic code may not be properly duplicated in an individual, resulting in a mutation.**

OBJECTIVE 26 **Define common disorders and abnormalities of the female reproductive system.**

1. **Sterility** (stuh-ri´-luh-te)—The inability to reproduce

   ✔ **NOTE:** A number of factors can lead to sterility in either sex, including injury, disease, birth defects, and psychological or emotional problems. For women, sterility comes with age as the body stops ovulating. A man may be fertile through a normal lifespan, though sexual drive and sperm count may decline with age.

2. **Premenstrual syndrome** (PMS)—A collection of conditions, including irritability, depression, fatigue, weight gain, edema, headache, and nervousness, that may accompany the premenstrual cycle in some women

3. **Pelvic inflammatory disease** (PID)—Any inflammation of the female pelvic organs, especially one caused by bacterial infection

   ✔ **NOTE:** Characteristics of PID include fever, foul-smelling vaginal discharge, pain in the lower abdomen, and abnormal uterine bleeding.

4. **Salpingitis** (sal-puhn-ji´-tuhs)—An inflammation or infection of the uterine tubes

5. **Oophritis** (o-uh-fri´-tuhs)—An inflammation of one or both ovaries

   ✔ **NOTE:** Oophritis usually occurs with salpingitis.

6. **Vaginitis** (va-juh-ni´-tuhs)—An inflammation of the vagina

7. **Leukorrhea** (lu-kuh-re´-uh)—A whitish discharge that accompanies some vaginal infections

   ✔ **NOTE:** Leukorrhea is the most-common reason women seek gynecologic care.

8. **Myoma** (mi-o´-muh)—A common, benign tumor of the uterine muscle

   ✔ **NOTE:** A myoma usually develops after the age of 30. Menorrhagia, backache, and other symptoms develop in proportion to the size, location, and growth rate of the tumor.

9. **Ovarian cyst**—A benign enlargement of the ovary often caused by a follicle that fails to rupture or a corpus luteum that fails to disintegrate

10. **Endometriosis** (en-do-me-tre-o´-suhs)—The presence of functioning endometrial tissue outside the uterus

11. **Breast cancer**—Cancer of the breast

12. **Uterine cancer**—Cancer of the uterus

13. **Cervical cancer**—Cancer of the cervix

14. **Ovarian cancer**—Cancer of the ovaries

15. **Prolapsed** (pro-lapsed´) **uterus**—A condition in which weakened uterine ligaments allow **retroflexion** of the uterus, which may then sink into the vagina

KEY TERM

Retroflexion (re-truh-flek´-shuhn)—An abnormal position of an organ in which the organ is tilted back acutely and folded over on itself

16. **Ectopic** (ek-taw´-pik) **pregnancy**—An abnormal pregnancy in which the embryo implants outside the uterine cavity

    ✓ **NOTE:** Kinds of ectopic pregnancy are abdominal pregnancy, ovarian pregnancy, and tubal pregnancy.

17. **Placenta previa** (pluh-sen´-tuh pre´-ve-uh)—A condition of pregnancy in which the placenta is implanted abnormally in the uterus so that it impinges on or covers the cervical opening

    ✓ **NOTE:** Placenta previa is a common cause of bleeding in the third trimester of pregnancy. Its cause is not known. If severe bleeding occurs, immediate cesarean section is usually required to save the mother's life.

18. **Abruptio placentae** (uh-bruhp´-che-o pluh-sen´-te)—Separation of the placenta from the uterine wall after 20 weeks of pregnancy

    ✓ **NOTE:** Abruptio placentae often results in severe hemorrhage, which can cause the death of the mother and the fetus. Immediate cesarean section must be performed.

19. **Preeclampsia** (pre-i-klam{p}´-se-uh)—A toxic condition of pregnancy characterized by hypertension, **proteinuria**, edema, hemorrhaging, and even stroke after the 24th week of pregnancy

    ✓ **NOTE:** The cause of the condition is unknown, but the most-serious complication is eclampsia, which can result in the death of the mother and the fetus (see item 20).

KEY TERM

Proteinuria (pro-tuhn-ur´-e-uh)—The presence in the urine of abnormally large quantities of protein

20. **Eclampsia**—The gravest form of pregnancy-induced hypertension, characterized by convulsion, coma, hypertension, proteinuria, and edema

    ✓ **NOTE:** Symptoms of eclampsia include a body temperature up to 104°F, severe headache, and blurred vision. The cause is not known.

21. **Spontaneous abortion**—The loss of an embryo or fetus before the 20th week of pregnancy

    ✓ **NOTE:** Spontaneous abortion is commonly referred to as *miscarriage*.

22. **Puerperal fever**—A bacterial infection of postpartum mothers that can progress to **septicemia**

    ✓ **NOTE:** Puerperal fever is usually a result of unsterile obstetric technique. If untreated, death may occur.

KEY TERMS

Puerperal (pyu-uhr´-puh-ruhl)—Of or pertaining to the period immediately after childbirth

Septicemia (sep-tuh-se´-me-uh)—A bacterial infection of the blood

23. **Mastitis** (ma-sti´-tuhs)—An inflammation of the breast, usually caused by streptococcal or staphylococcal infection

✔ **NOTE:** Mastitis is most common in the first two months of lactation and is characterized by pain, swelling, redness, and fever. If untreated, abscesses may form.

OBJECTIVE 27

Assignment Sheet 1—Practice Critical Thinking: Complete Case Studies that Evaluate Infant Health and Determine Required Care

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Investigative report followed agreed-upon format	_____
• Investigative report met agreed-upon criteria	_____
Overall rating	_____

Evaluator's comments _____

_____

_____

INTRODUCTION

Upon the birth of a child, an immediate concern is the health of the child, especially if there have been complications with the pregnancy or delivery. It is a fairly common practice to place a fetal monitor on the laboring mother once she enters the hospital. The fetal monitor detects the stress that the fetus is experiencing as indicated by vital signs such as fetal heartbeat. A long labor may result in the infant being deprived of placental blood flow, an extended exposure to the birth canal, a prolonged period after the amniotic sac is ruptured, and times of stress on the mother.

For these reasons, most hospitals have implemented a system for evaluating the health of a baby at birth. At the moment of birth, the umbilical cord is clamped and then cut. The clamping is important to minimize blood loss and particularly the loss of the mother's antibodies. The child's nose and mouth are then **aspirated** to remove mucus and other fluids that might interfere with breathing, for the baby is now independent of the mother and sustaining life on its own. At this point, most hospitals evaluate the health of the baby, using a standard referred to as the *Apgar score*. The Apgar score evaluates five aspects of the child and gives a score of 0, 1, or 2 based on the scale on the next page.

KEY TERM

Aspirate (as´-puh-rat)—To draw by suction

Characteristic	Evaluation criteria	Score
Heartbeat	Over 100 beats per minute	2
	Less than 100 beats per minute	1
	No heartbeat	0
Respiration	Strong, vigorous cry	2
	Weak cry	1
	No respiration	0
Muscle tone	Baby shows active movement	2
	Some movement	1
	No movement	0
Reflex (stimulation of foot)	Baby cries in response	2
	Baby grimaces in response	1
	No response	0
Color	Baby flushes with blood flow	2
	Baby shows **cyanosis** in extremities	1
	Baby shows widespread cyanosis	0

KEY TERM

Cyanosis (si-uh-no´-suhs)—Blue coloration of the flesh because of a lack of oxygen

EXERCISE

ACTIVITY CHECKLIST

Put a checkmark on the blank line before each activity below and on the next page as you complete it.

_____ 1. Review the information in the introduction to this assignment sheet.

_____ 2. Read each of the five case studies in Part A of the assignment sheet.

_____ 3. Determine the Apgar score for the child in each case study, and write the score on the blanks provided in Part A on the following pages.

_____ 4. Have your instructor evaluate your answers to Part A.

_____ 5. Read Part B of the assignment. To complete Part B of this assignment, consult with personnel at your facility or at a facility in your area to determine the procedures that would be required for each of the infants described in the five case studies in Part A.

_____ 6. Check with your instructor to determine the format (written report, PowerPoint presentation, poster, etc.) your instructor wants you to follow in completing your investigative report. Describe that format on the blanks provided on the next page.

_____ 7. Check with your instructor to agree upon the criteria he or she will use to evaluate your investigative report. Describe those criteria on the blanks provided below.

_____ 8. Complete your investigation and give your investigative report to your instructor for evaluation.

Format of investigative report _____

_____

_____

_____

_____

Evaluation criteria _____

_____

_____

_____

_____

PART A

CASE STUDY 1

A male child has a heartbeat of 21 in 15 seconds. He moves his arms slightly and lifts one foot momentarily. His breathing is labored and wheezy, and there is some cyanosis in his fingertips and toes. When his foot is stimulated, he draws up and clenches his fists. What Apgar score should be given?

Apgar score _____

CASE STUDY 2

A little girl is born 3 weeks prematurely. Her heartbeat is 107 beats per minute and she produces a faint whimpering sound. There is no sign of cyanosis. She is not moving and makes no response to foot stimulation. What is her Apgar score?

Apgar score _____

CASE STUDY 3

A female child exhibits a heartbeat of 112 beats per minute and is crying vigorously. Her feet and arms are in constant motion and her crying intensifies sharply when her foot is stimulated. At first, there are no signs of cyanosis. However, a few minutes after birth, she begins coughing. Her fingers and toes turn blue and the cyanosis spreads quickly to her trunk. Five minutes after birth, the baby stops breathing and lies still and is unresponsive, although the heartbeat is still 110 beats per minute. What is the child's initial Apgar score and the score after 5 minutes?

Apgar scores _____

CASE STUDY 4

A woman is admitted to the hospital for delivery of her child, eight and one-half months into the pregnancy. The woman has previously been admitted for various injuries and disorders, with records indicating that alcohol consumption was involved in all of the incidents. The child is born with a small head, thin lips, and narrow eye openings. His heart rate is 82 beats per minute and a bit erratic. Movement is sluggish, though the child does cry and cries vigorously when the foot is stimulated. Initially, cyanosis is widespread, but as the baby continues to cry, the cyanosis becomes limited to the fingertips, the toes, and tops of the feet. The attending physician instructs that a record of suspected fetal alcohol syndrome be made. What is the initial Apgar score and the Apgar score once cyanosis subsides?

Apgar scores _____

CASE STUDY 5

The obstetrician has been closely following the case of a patient who is Rh-negative and about to have her second child. Indications are that the fetus is undersized and there have been signs of fetal stress. The physician advises the hospital to be prepared to administer a gradual exchange transfusion to the infant. At birth, the baby weighs 5.5 pounds (2500 grams). She has cyanosis in her extremities and an orange cast to the entire body. The heartbeat is 92 beats per minute. The baby moves and stops, cries and stops. When her foot is stimulated, she cries again, moves for a moment, and then stops. What Apgar score would you give her?

Apgar score _____

PART B

Complete an investigative report.

Consult with personnel at your facility or at a facility in your area to determine what procedures are required for each of the infants described in the five previous case studies in Part A of this assignment sheet.

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